Fire for Effect:
Field Artillery and Close Air Support in the US Army

John J. McGrath

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Foreword

The Combat Studies Institute is pleased to announce its latest Special Study, *Fire for Effect: Field Artillery and Close Air Support in the US Army*, by historian John J. McGrath. The genesis of this work was the controversial decision in 2001 to deploy Army combat units to Afghanistan without their supporting field artillery units. *Fire for Effect* provides a historical survey of the relationship between field artillery and close air support (CAS) in the US Army since World War I.

A recurring theme in this survey is the desire of air operators for independence in operations. This first occurs at the organizational level in the development of strategic bombing theories and forces. The desire for independence emerges also in Air Force doctrine which stressed the importance of interdiction over CAS missions. Eventually, the Army aviation community Also sought independence in the idea of the independent strike of attack helicopters, known as the deep attack. This last concept became at least partially discredited in the sands of Iraq in 2003.

Independent air operations contrast with the Army's traditional combined arms concept where the arms and services work together to complement each other's strengths and cover weaknesses. The field artillery has long been a key member of the combined arms team. The Army ground commander has controlled all the elements of this team except the fixed-wing close air support.

Despite the differences in theory and practice, since the 1960s the two services have developed cooperative and coordinated systems that have solved most difficulties. Over these last 40 years, much progress has also been made with the development of precision guided munitions, giving both services the ability to use point fire weapons in their delivery of CAS. As this study shows, the introduction of sophisticated precision weapons has separated CAS from artillery, creating distinct and complementary systems of fire support. Both, however, remain necessary to give the ground commander responsive and powerful fires in the broad variety of combat situations that characterize the modern battlefield.
CSI – The Past Is Prologue!

William G. Robertson
Director, Combat Studies Institute

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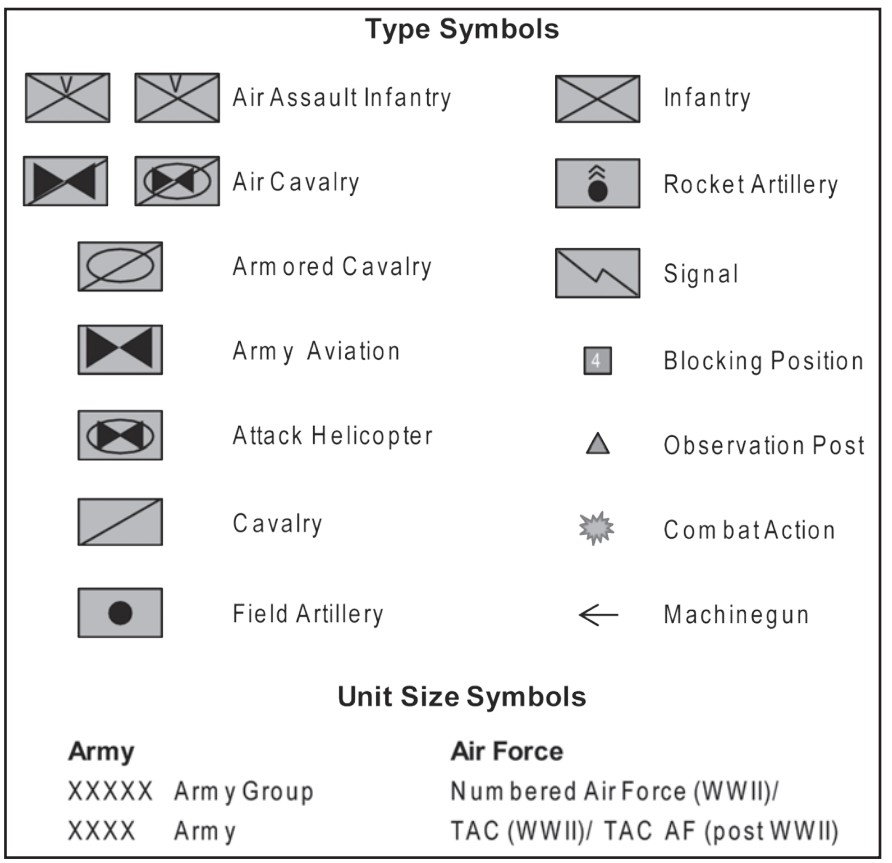


Introduction

This special study provides a historical survey and comparison between two key elements of the joint combined arms team, indirect fire support, as provided by field artillery and mortars, and direct aerial fire support (close air support (CAS) and interdiction) provided by aerial platforms (fixed- and rotary-wing aircraft). Since the beginning of modern combined arms operations in World War I, there has been a continual improvement and refinement of ground and air fire support means. But, at times, there has been controversy over the use of the respective delivery means.

This study discusses the interplay and use of air and ground fire support elements in the modern period. The work begins with a brief background on the evolution of modern field artillery but is primarily concerned with the period from 1914 to the present. While it discusses all major technological and tactical innovations, the focus is clearly on the United States Army and United States Air Force. Since at least 1941, the United States has led the way in technological and organizational developments in both aviation and field artillery.

The emphasis of the survey is on technological and organizational developments, structures, innovations, and techniques. The stress is not, however, on details of technology but, rather, on the capabilities that technological developments have given to the weapons or fire support systems.

The utility of cannon field artillery and close air support both separately and in conjunction to each other have specific but complementary characteristics. When used together in ways that maximize their strengths and minimize or cover for each component's weaknesses, the joint combined arms effect presents the enemy with a difficult, sometimes irresistible force. While this presents the optimum usage scenario, it will be seen that institutional and organizational factors sometimes prevent this from happening, while at times arguments in favor of or against certain arms have not been based on the capabilities or characteristics of the specific arms, but on other considerations external to the joint combined arms team. At least twice in modern American military operations, ground forces have had to deliberately fight without field artillery support. The decision to do this was based on factors not related to the effectiveness of field artillery and the results were uneven at best.

Since World War I, field artillery has had certain characteristics. Except when armed with expensive precision munitions that are aimed at the target after firing or fired in direct-fire mode, cannon field artillery

is an area fire weapon system. Rounds land within a certain, predictable elliptical pattern, scattered slightly along the line of fire. The effectiveness of artillery firepower has been based, therefore, not on precision but on mass. While the fire would destroy some enemy troops and positions in the target area, some will survive but all will have to take cover for protection. Artillery, therefore, does not naturally destroy the enemy target, but, rather, it neutralizes it, limiting its tactical effectiveness while it is under fire.[1]

Firing from positions away from the direct-fire effects of enemy weapons has allowed field artillery protection from these weapons and at least temporary protection from the enemy artillery. Accordingly, a cannon unit could fire many rounds with relative immunity. Continually improved firing techniques and technological advances throughout the century have enhanced the ability of the field artillery to fire quickly and accurately with the parameters of area fire.

This increase in responsiveness also produced an increase in field artillery flexibility. While in World War I most artillery fire had to be preplanned or targeted via maps and a relatively rigid timetable provided coordination, improved techniques and weapons systems made indirect fire support a key factor in the success of military operations, particularly American, in that war.

Aside from responsiveness, field artillery contains other strengths. In terms of munitions, comparatively speaking, artillery rounds have been cheap and come in an array of varieties suitable for different situations and targets. Organizationally, armies have developed a complicated support relationship with the units they support where firing batteries have long been tied into the units they support through a complicated relationship where the overall ground commander directs the goal of the fire while the senior artillery commander or his representative directs it.

Field artillery weaknesses have traditionally included limited range, lack of mobility, setup time, the counterbattery threat, and coordination difficulties. The first three factors are intertwined. Unlike aviation, artillery fires from fixed positions, which provides the guns with a finite range. Therefore, a static operation or one within a small area is ideal. In an operation in which the supported force moves forward or retreats to provide continuous support, the artillery would have to move in echelons, meaning the amount of available artillery would be limited until the whole force had moved and deployed. In the past, batteries would also have to register in their new position to ensure accuracy of fires. While in a position and firing, field artillery batteries had become increasingly more vulnerable to counterbattery fires of the enemy artillery as targeting became more

sophisticated. In the latter stages of the Cold War, NATO batteries were expected to move to new positions virtually after every firing mission.

Coordination between the supported and the supporting unit had been an artillery vulnerability principally through the weakness of communications means, particularly in mobile operations. Indirect fire depended on the presence of an observer. Vulnerable field telephone lines or unreliable radio sets linked the observer to the firing battery. This system required the observer to adjust the fire on the target, which could be time consuming.[2]

Improved organizational structures, such as the fire direction center created in the 1930s, the fire support team fielded in the 1970s, technological enhancements, including improved radios in World War II, digital communications in the 1980s, and the development of global positioning systems in the 1990s, have minimized artillery vulnerabilities in terms of communications.

Close air support, which for purposes of this study, includes what the US Air Force defines as close air support (aerial fires delivered close to ground forces) and air interdiction (aerial fires delivered in the support of ground forces but beyond artillery range) limitations inherent in indirect fire observer and communications link.

Close air support is armed aircraft direct weapons fire onto specific targets. In World War I, such fire was principally machineguns. Since then, however, bombs and missiles have been the usual weapons used in most fixed-wing CAS missions. Attack helicopters, developed in the 1960s and after, have mounted rapid-firing cannons and missiles. As a direct-fire weapon, CAS shooters fire at specific targets on the ground, which provides them a much better opportunity to hit an exact point on the ground and to judge the effect of that fire than field artillery batteries.

This relative precision provides CAS fire with a potential for immediate devastating effects, particularly against point targets. CAS also has an effectively unlimited range in terms of supporting ground operations. Accordingly, it cannot only support mobile operations, but it can attack important targets and installations beyond the limits of artillery and direct-fire weapons, providing a less immediate, but potentially decisive, effect (interdiction).

CAS is also inherently flexible. Even when fires have been preplanned, if the ground situation has changed, aircraft can be diverted to new targets. CAS can also be used closer to friendly forces than artillery as long as the aircrews clearly recognize where the friendly forces are. CAS is

also flexible in that, once in the air, terrain does not restrict it, either for targeting or for maneuvering.

Close air support has its own set of vulnerabilities. The aircraft are vulnerable to air defense fires. Ideally, to maximize CAS effectiveness, specialized aircraft are equipped with armored plating and other technologies designed to enhance survivability and firepower effects against ground targets. At various times, armed forces have developed such craft. The A-10 Thunderbolt II is a recent example. Attack helicopters also are principally designed for close air support.

While range is relatively unlimited for the purposes of ground support, fuel supply and aircraft inventory could limit availability. Air support also requires the establishment of relatively elaborate air bases staffed with ground crews, maintenance shops, and security forces. This logistics tail is indirect compared to that of the artillery, but it is no less an important factor in the adequate fielding and utilization of air support elements.

Coordination and communications between the supported and supporting unit has also been a traditional vulnerability of CAS. While the weapons are line of sight, the shooter may not understand what he sees or may misinterpret the ground situation. While both field artillery and CAS fires are subject to potential fratricidal situations, their terms are different. Artillery fratricide is usually an error in gunnery. Air fratricide is usually a misinterpretation of the target. Aircrews have less chance to evaluate their targets, and since they are within direct-fire range of enemy weapons, they have to decide quickly to engage. This effect is common to all direct-fire weapons, but the effects of air fire can be more drastic. CAS is also, along with all air assets, subject to bad weather conditions, which can restrict flight operations.

Together, CAS and field artillery assets, along with the units they support provide the joint combined arms team. While each component of the joint combined arms team has specific and complementary characteristics, the basic historical contrast between close air support and field artillery fires has been threefold: responsiveness, precision, and organizational. The interpretation of these three factors and the application of these interpretations is the basic continuity that ties together the opposition between field artillery support and CAS. This special study looks at all these issues in a chronological structure, followed by a detailed discussion of each of them in greater detail.

Notes

1. Bradley J. Meyer, "Operational Art and the German Command System in World War I," (PhD diss., Ohio State University, 1988), 278-279.

2. Bradley J. Meyer, 273, 275.

Chapter 1

The Rise of Field Artillery and the Beginnings of Close Air Support

Field Artillery Before 1914

Since the development of gunpowder as a tool of war, armies had organized their forces into three basic combatant arms: infantry, cavalry, and artillery. The artillery formed three functional subelements: coastal, siege, and field. Coastal artillery was emplaced into fixed fortifications near key coastal installations. It was designed to sink enemy naval vessels. Siege artillery was composed of heavy guns of large calibers with limited mobility. Such guns were designed to defeat enemy fortifications, usually surrounding cities. Operationally, armies moved siege artillery forward slowly and required a large ammunition train.

Field artillery developed from siege artillery. The cannons were smaller, able to be mounted on wheeled horse-drawn carriages. Horse-drawn caissons carrying the ammunition supply supported the cannons. Because of its increased mobility, field artillery was able to accompany infantry on the battlefield. An even lighter variant, horse artillery, was able to accompany cavalry. In the 17th and 18th centuries when armies were small and military operations relatively methodical, the role of field artillery developed slowly. Armies fought battles by arraying their infantry shoulder to shoulder in two or three ranks. Infantrymen employed the mass fire of their individual muskets, which had the relatively short range of from 50 to 100 yards. Artillery cannons had a range of 400 yards and were aimed crudely using line of sight. Artillery employment was limited to covering the assembly of the infantry before battle and operating on the flanks of the line when possible, to firing on the enemy infantry and artillery without firing over the friendly infantry.[1]

Both the Continental Army and its British opponent rarely massed field cannons. The pieces available were usually distributed in pairs among infantry units. By late 1776, General George Washington had distributed batteries of from 8 to 10 guns among the infantry brigades of the Army. At Trenton in December 1776, Continental artillery played a decisive role in the surrender of the Hessians. The artillery assigned to each brigade blunted counterattacks with massed, close-range fire.[2]

Recent archaeological research on the 1778 Battle of Monmouth, Washington's last pitched battle, showed that Continental Army artillery, already considered to have played a key role in the battle, was even more

important in halting the British counterattack than previously thought. Deployed in a covered position, several American batteries completely broke up the advance of the British infantry through devastating close-range antipersonnel fire.[3]

Several decades later, Napoleon, a field artillery officer by training, revolutionized the use of the arm, using massed fires in an offensive role. Improved carriage and gun designs gave the arm an increased mobility that paralleled the development of the French organizational system of mobile army corps. The corps, equipped with artillery and infantry, provided a decentralized combined arms team that maneuvered within a day's march of other corps and could fight on its own until reinforced. For pitched battle, Napoleon brought his corps together and consolidated his cannons to form a grand battery that directly bombarded the enemy infantry and artillery before the attack of his massed infantry. Era infantry was equipped with the smoothbore musket whose effective range was 150 yards. The roughly 300-yard range of field artillery firing antipersonnel (canister) munitions far surpassed this. Accordingly, Napoleon's grand battery could get in fairly close to the enemy infantry and bombard it with great effect, while not at risk itself from fire from enemy infantry. After the bombardment, the French infantry would then attack in mass, firing a single volley once in range, then using the bayonet.[4]

With a smaller army primarily based along the frontier, American artillery developments were slower. Artillery actions in the War of 1812 more closely resembled those of the Revolutionary War. Finally, in the Mexican War, Napoleonic-style field artillery tactics appeared. At Palo Alto in May 1846, Major General Zachary Taylor grudgingly employed his small amount of artillery to bombard the Mexican artillery. The artillery proved to be the decisive factor as the Mexican forces withdrew, based entirely on the effect of the American artillery fire. At Buena Vista in February 1847, Taylor defeated a Mexican force three times larger primarily through the superiority of his artillery, which played a key role in repulsing Mexican infantry attacks. In Major General Winfield Scott's campaign against Mexico City, field artillery also played an important role, particularly in support of assaults at Cerro Gordo and Chapultepec.

The American forces in the Mexican War were small compared to those of the Napoleon campaigns. But the Civil War in the 1860s saw the competing sides field much larger forces, including artillery. For the first time, American field artillery was employed in a manner the French emperor would have recognized. However, by the time of the Civil War period, infantry was now almost completely reequipped with rifled

muskets, weapons that increased the range of the infantry out to 300 yards. This negated the Napoleonic range differential that favored the artillery and exposed massed artillery to enemy small-arms fire.

Artillery technological developments included the fielding of rifled cannons with longer ranges and various munitions. However, such pieces were not as durable as the more numerous smoothbore cannons. Era fire control techniques mitigated against the longer ranged rifled pieces. On the battlefield, direct line of sight usually did not extend as far as the extended range of the weapons. Accordingly, both sides generally relegated their rifled pieces primarily to firing on the enemy artillery.[5]

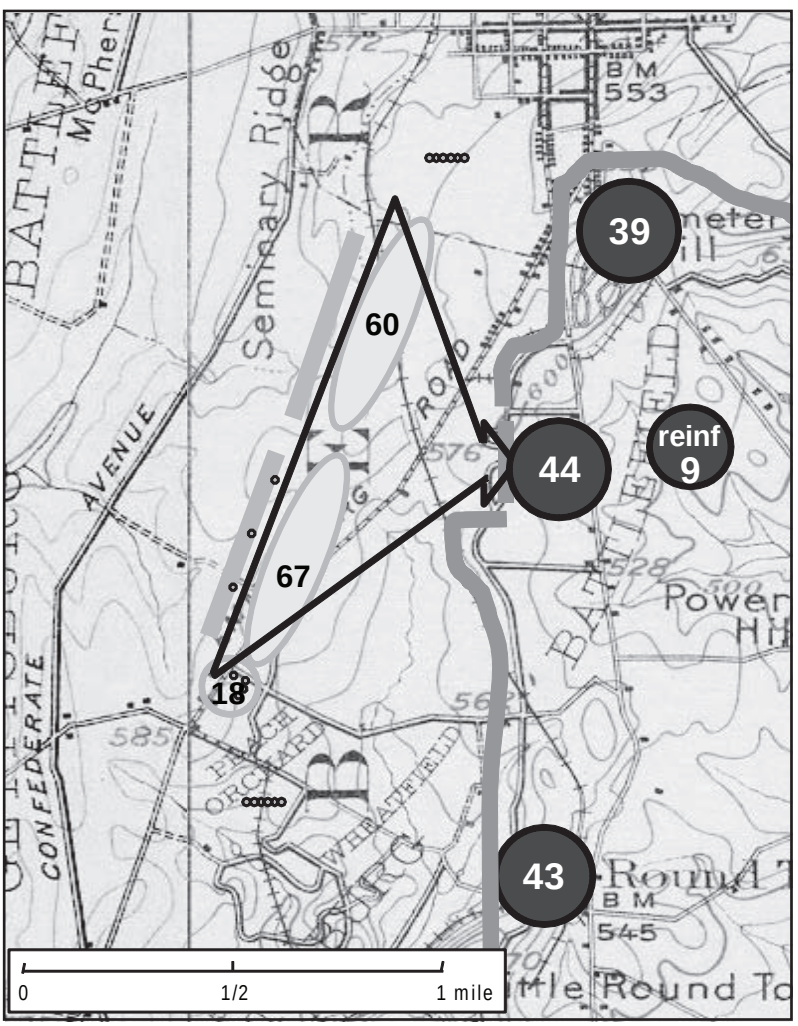


Figure 1. Pickett's charge, illustrating artillery employment.

The third day of the Battle of Gettysburg, 3 July 1863, provides a good example of field artillery employment during the Civil War. After 2 days of battle, the Confederate forces, led by General Robert E. Lee, had failed to sweep from the field the Federal forces, under Major General George Meade, after almost succeeding on both previous days. Lee determined to mass most of his fresh units in a large infantry assault against Meade's center. The approximately 12,000 Confederate attackers had to cross three-fourths of a mile of open farmland to reach the Union position. To support the attack, Lee massed most of his army's artillery, 135 cannons. These cannons primarily had to fire an intensive preliminary bombardment designed to cripple the Union artillery, hopefully preventing the enemy cannons from hindering the Confederate attack. The secondary mission was to damage the enemy infantry defending the point of attack.[6]

Throughout the war, the opposing sides debated the proper organization for artillery. In both armies, batteries, usually of four guns, were the basic artillery unit. Organization to control the batteries evolved over time, with debate primarily concerned with the amount of centralization needed to effectively provide artillery support and whether artillery or infantry officers should control artillery fire. Ultimately, both sides organized their artillery into larger units, called battalions in the Confederate service and brigades in the Union service.

Confederate eastern commander General Robert E. Lee had formerly allocated artillery batteries to specific infantry brigades. In February 1863, Lee consolidated batteries, typically four in number, into artillery battalions. Four battalions were assigned to each infantry corps along with a small cannon reserve. The senior artillery officer in the corps controlled these battalions, with a battalion attached to each of the corps three infantry divisions and the last battalion retained as corps reserve. Lee did not retain an artillery reserve at his level. While he had an army artillery chief, Brigadier General William Pendleton, Lee used him only in an administrative capacity. Pendleton, a Protestant minister in civilian life, proved to be a weak artillery chief in previous campaigns, particularly in the Antietam campaign in September 1863. Therefore, Lee usually bypassed him for operational missions, depending on the competency of the corps artillery chiefs. While artillery was centralized at the corps level in Lee's army, there was no real overall chief at the army level.[7]

Union Army of the Potomac organization was similar and different at the same time. The main difference was the presence of a strong army-level chief of artillery, Brigadier General Henry J. Hunt. Hunt was a career artillery officer who had helped write the prewar artillery drill

manual. By July 1863, Hunt had served as chief artillery officer under four different army commanders and had orchestrated highly successful artillery defenses at Malvern Hill and Fredericksburg in 1862. Hunt's role as artillery chief was hazy. Originally, he only directly controlled the artillery reserve. Defeat changed this.

After the disastrous Battle of Chancellorsville in May 1863, at Hunt's insistence, army commander Major General Joseph Hooker reorganized the artillery into brigades of between four and eight batteries each. Every infantry corps received 1 of the new brigades, and the artillery reserve contained an additional 4 brigades (totaling 21 batteries). Hooker gave Hunt the authority to control all the army's artillery, overriding the corps commanders as necessary. Unfortunately, Major General George Meade replaced Hooker just days before the Battle of Gettysburg and had issued no orders granting or denying Hunt such authority. During the battle of 3 July, Hunt had to use his forceful personality and the loyalty of the artillery officers commanding the corps artillery brigades to get the corps artillery to do his bidding. In this, he was mostly successful at positioning batteries and directing fire. However, in one case, a new corps commander overrode his instructions.[8]

For the barrage, the Confederates massed 135 cannons in 42 batteries. On the northern side of the assault zone, Third Corps artillery chief Colonel R. Lindsey Walker and Second Corps artillery chief Colonel J. Thompson Brown controlled 60 guns in 24 batteries. Lieutenant General James Longstreet's First Corps was in charge of the attack and Longstreet's artillery chief Colonel Edward Porter Alexander controlled 18 batteries and 67 guns. This total was the most cannons any Confederate army assembled for a single attack or defense during the war.[9]

Longstreet depended on Alexander to support the attack, although he had no actual command authority over Walker and Brown. As the commander of the bulk of the artillery supporting the attack, Alexander stressed the bombardment mission. Although Lee wanted the artillery to move forward behind the infantry, Alexander thought he did not have enough ammunition to do both missions effectively. Therefore, he intended to use up all his available long-range ammunition in the barrage. The cannons would remain in position with their basic load of short-range munitions, prepared to repulse any enemy counterattack. The barrage would continue until the enemy was silenced or his guns ran out of ammunition.[10]

Lee hoped that the bombardment would neutralize the Union artillery either through ammunition depletion or destruction by fire. The

bombardment would also focus on the 5,750 Union troops defending the 538-yard (0.3-mile) frontage that was the assault's objective, hoping to demoralize and at least partially weaken the strength of the defending Union infantry. Longstreet's infantry force of approximately 11,500 would then be able to advance on the Union center without fearing enemy artillery bombardment against a force it outnumbered 2 to 1.[11]

Under Lee's operational concept, the artillery's secondary mission was to provide direct support to the advancing infantry. While some of the batteries he did not directly control intended to move up after the infantry advance, the corps artillery chief believed that he could not afford to take any guns from his barraging force. Instead, he scraped together a special force of eight smoothbore cannons capable only of short-range fire to advance in front of the infantry and position itself just beyond the Union infantry's range. This force would then fire antipersonnel munitions at the enemy, softening up the defenders right before the infantry attack. Alexander considered this an experimental use of artillery. However, because of interference by Pendleton and a fear of fratricidal fires from the Confederate artillery to the north, the battery commander moved the smoothbores during the bombardment and Alexander could not find them when it came time to use them.[12]

During the bombardment, Alexander managed to withdraw two cannons from each battery he controlled to create a new, 18-gun force to accompany the infantry. He moved this detachment behind the right division (Pickett's) of the assault force, but aside from knocking holes into a wooden fence along the Emmetsburg Road, it had little impact on the ensuing Confederate debacle.[13]

By plan, the Confederate infantry advance was to begin once the bombardment had silenced the Union artillery and seriously damaged the Union infantry in the center of Meade's Cemetery Ridge position. Alexander feared that the black powder released by his batteries would make such an assessment difficult through a lack of visibility and recommended a start of the infantry movement halfway through the bombardment. Longstreet eventually vetoed this proposal, intending to order the advance himself, based on a subjective analysis of the effect of the bombardment.[14]

Without specific knowledge of Lee's plans, Union commander Meade did not mass his cannons. The army's artillery chief, Brigadier General Henry J. Hunt, was a seasoned artilleryman who was good at his job. Hunt was obliged to protect the entire Union infantry line, while retaining a few batteries in an artillery reserve force. Accordingly, the Union forces did

not use their superiority in numbers to mass their more numerous artillery pieces.[15]

However, the Army of the Potomac still had 127 cannons within range of the Confederate artillery and attacking forces. These were in three groups. Of these, with reinforcements from the artillery reserve, there were 87 pieces along the defensive line that the Southerners were about to attack and 39 positioned to the north on Cemetery Hill. The former contained two groups: 44 guns under the control of Major General Winfield Scott Hancock's Second Corps artillery brigade in the center of the line at the point of the Confederate attack and a force of 43 cannons, primarily from the artillery reserve, in covered positions to the south of Hancock's position near Little Round Top (figure 1). In addition, Hunt positioned the uncommitted units of the artillery reserve behind the center of the Union position.[16]

The subsequent artillery duel the Confederates did produce was the largest bombardment/counterbombardment of the war. It lasted between 1 and 2 hours.[17] At its conclusion, three divisions of infantry began their advance, with most of the supporting artillery out of long-range ammunition. The barrage did not provide Lee and Alexander with the results they expected. Although the Confederates slightly outgunned the Union gunners, Hunt and the Union forces easily won this contest. Not only were the Union guns still mostly intact, after the bombardment, they played a key role in the repulse of the subsequent Confederate infantry attack. The Union defending Union infantry also was largely unhurt by the bombardment as most Southern rounds fired over the heads of the defenders.[18]

Centralized management made the difference. The key factor on the Union side was Hunt's focus. He realized his mission was to defeat the enemy infantry, not his artillery. Hunt, therefore, tapered the counterbattery fire of the Union artillery, saving ammunition to fire at the advancing foot soldiers. These troops would have to move across three-fourths of a mile of open terrain to reach the Union line, making them good targets. But Hunt's plan was counterintuitive, particularly for the infantry commanders. Hancock, the corps commander at the fulcrum of the attack, who was new to corps command, demanded that the Second Corps artillery continue to fire at the enemy artillery to boost the morale of the troops. Hancock was so zealous that he attempted to compel guns that were not part of his command to fire. Hunt put a stop to this, creating a new chapter in the historic debate over who should control artillery fire, senior infantry or artillery officers.[19]

While Hunt's guns did put big holes in the attacker's formation as they advanced across the open area, Hancock's guns, at the fulcrum of the attack, were silent. The corps commander had kept the guns he controlled firing continuously at the Confederate artillery until the cannons ran out of long-range ammunition. Accordingly, as Hunt had feared, the guns closest to the Confederate attack were silent as the enemy infantry advanced in close formation until the Southerners got within canister shot range. Hunt felt that Hancock's interference made the battle a lot closer than it had to be—the enemy actually briefly breached the Union main defensive line before being repulsed. Later, Hancock still felt he was right and complained to Meade. While Meade, an infantryman, agreed with Hancock, he did nothing to change Hunt's role due to the artilleryman's obvious effectiveness.[20]

During the battle, Hunt showed flexibility, shifting guns around and bringing up reinforcement. Hunt may have even been responsible for initiating the Confederate infantry attack. As the artillery duel continued, Hunt conferred with Major Thomas Osborne, officially the Eleventh Corps artillery chief, the commander of the artillery on Cemetery Hill north of Hancock's Second Corps. The officers discussed how long the enemy would continue its barrage. One of the officers suggested that, if the Union artillery completely stopped returning fire and withdrew slightly to the rear, perhaps the Confederates could be enticed to begin their infantry attack. With Hancock's artillery already silenced by ammunition shortages, such a cessation of Union artillery fire could appear to the Confederates only as the successful silencing of the enemy artillery.[21]

And so it was. Although later Confederate accounts downplayed the retreat of the Union artillery, this stratagem obviously had a decisive effect on Longstreet's decision to begin the attack. As mentioned previously, the Confederate decision to start the assault was ultimately decided based on subjective analysis of the effectiveness of the bombardment. Longstreet and Alexander agreed that the Confederate guns had silenced their Union counterparts. The smoke from the firing obscured the Southerners' view of their fire effectiveness. Through the smoke, Longstreet was confident of the positive effect of the fire on the Union guns and infantry. In this, he was correct to a point. Hancock's guns were either destroyed or out of ammunition; Hunt quickly provided replacements from the nearby artillery reserve to this key sector as Pickett's infantry advanced on it.[22]

Another important factor was the depletion of ammunition. The Confederate leadership was more willing to accept the fact that the Union guns were finished because their own guns were almost out of ammunition.

After Alexander told Longstreet that he could not continue the artillery barrage much longer, the corps commander ordered the infantry to move forward. The troops dressed their lines and began to advance through the powder smoke toward the Union lines almost a mile away.[23]

As the infantry advanced, the Union guns initially remained silent. But as the Confederates came clear of the smoke from their guns, the Union cannons in the south and then in the north opened fire. Fire from Cemetery Hill totally unhinged the northern wing of the Southern attack to the point that several units retreated to their start lines.[24]

It took the Confederate formation about 20 minutes to close within short-range artillery and infantry small-arms range of the Union position. In that timespan, one historian has estimated that the Federal artillery so disrupted the Southern advance that, out of an original force of 11,500, only 5,120 soldiers remained in line when the formation reached small-arms range. The Union defenders in the attack zone, originally 5,750, had lost approximately 350 soldiers. Therefore, in the final assault, the Confederates were trying to take a Union position defended by slightly more Federals than they themselves had attacking. With the range reduced, several of Hancock's batteries could now rejoin the fight with canister ammunition.[25]

The Union field artillery had reduced the odds of the Confederate attack from more than 2 to 1 to less than 1 to 1 even before the attackers were within range of the firepower of the Union infantry. That the Southern infantry was able to even briefly breach the Union defenses shows clearly how decisive the Union artillery advantage had been. If the Confederate infantry had managed to remain largely intact when it reached small-arms range, its advance may have proved irresistible. Lee's long maligned belief in the effectiveness of the frontal assault failed primarily because the Confederates lost the artillery battle, not because it was inherently impossible for infantry to assault slightly fortified defensive positions in 1863. However, in this era, no one had developed the effective use of the cannon in the offensive. Defensive field artillery fire had, however, virtually defeated Pickett's Charge on its own through its effective firepower.[26]

The Confederate artillery failure had several causes. As previously mentioned, there was no centralized management of the guns. While on paper Pendleton was the artillery chief of the Army of Northern Virginia, he actually only functioned in an administrative capacity. The Confederate artillery in reality operated in a decentralized manner, with direction at the corps level. In the case of 3 July, this meant that each artillery battalion commander directed fire where he thought best. Accordingly, the guns did

not concentrate their fire on the point of attack but instead spread it out along the Union line.

Table 1. Typical Characteristics of Civil War Field Artillery.[32]

Method of fire	Direct
Targeting	Line of sight from the guns
Rate of fire	2 per minute
Basic load of ammunition	Long range 112
	Short range (canister) 16
Maximum Effective Range	
High explosive	1,800 yards
Antipersonnel	200 yards

Union gunner Hunt recognized this mistake immediately. His after-action report and postwar writings criticized the lack of concentration in the Confederate fire. Without an overall fire plan, each Confederate artillery commander fired at the Union positions he believed were the most dangerous, usually those closest to his guns. Decentralized control in offensive operations provided that Confederates did not group their cannons in order to present an irresistible mass of fire on the defenders at the point of attack. Union artillery losses in Hancock's sector were heavy, but infantry losses were less so because the fire was dispersed along the line.[27]

In addition, technology, gunnery, and geography favored the Federals. Hunt noted that most Confederate artillery rounds fired high. Contemporary gunnery techniques saw the gunners aim each shot by eyesight. The Confederate artillery fired from positions generally parallel to their targets. This meant that cannon elevation was on a line with the gun tube. Any minor error would cause the rounds to overshoot the target. Given the terrain and the powder smoke, this error would be less apparent to the gunners. With the Union infantry laying down during the barrage, many Confederate rounds landed to the rear of the troops, mildly hindering logistical and headquarters operations.[28]

Overshooting had less effect on Union guns that were in positions chosen for their defensive strength and their ability to support the infantry defensive lines. This meant that Union batteries, especially those firing on the advancing infantry, could fire across their targets instead of straight into them. Almost all the Union battery positions were perpendicular to the Confederate attack. Federal gunners could accordingly see the strike of

their rounds better in relation to their targets. Even the enemy deployment favored the Union guns that were parallel to the Confederate artillery. Northern overshots ended up in the assembly areas for the infantry units waiting to attack.[29]

Ammunition expenditure also played a big role in the ineffectiveness of the Confederate artillery. Although supply lines and overall available caches of ammunition were factors, the key issue was the basic load of each gun—the amount of ammunition that each gun caisson could carry. Even with more plentiful ammunition, the size of their caissons also placed limitations on the ammunition supply of the Union artillery. One caisson serviced each cannon and for the most common artillery piece, the 12-pounder Napoleon, contained 112 long-range rounds and 16 short-range canister rounds. The pace of the Confederate bombardment used up the available ammunition within less than 2 hours. Hunt's handling of his guns retained Union ammunition supply at the guns until the attack was repulsed. At the end of the bombardment, the Confederates could not afford to stop to resupply to have artillery available to support the infantry advance. Alexander believed that the surviving Union guns were equally out of ammunition and a pause would also give them a chance to resupply. Luckily for the Federals, Hunt was in charge of the artillery and not Hancock. Hunt foresaw the need to retain rounds for the second phase of the action.[30]

In many ways, Pickett's Charge was a harbinger of the dominance of artillery in the hands of defenders in the next century. The brilliant employment of cannons and guns had proven to be decisive in defeating a massed infantry attack. The Union artillery had reduced the attacking force to a number too small to hope for success in close battle with the enemy infantry. While many observers consider the success of the defense in the Civil War to be based on the increased firepower and range of the rifled musket, Hunt's employment of artillery at Gettysburg proved that the decisive blow could be struck before the attackers were even within range of the infantry's rifled muskets.[31] Table 1 shows the typical characteristics of Civil War field artillery.

Field Artillery in World War I

Just 5 years after the conclusion of the Civil War, artillery played an important part in the Franco-Prussian War. Prussia fought a series of short wars in the 1860s during which its artillery was modernized. By the time of the 1870 confrontation with Napoleon III's France, the Prussian artillery consisted of steel breech-loading Krupp rifled guns. These

weapons were superior to the French artillery in every measure—range, accuracy, and reliability. Ironically, however, the Prussians were hindered in taking advantage of this advantage because French infantry weapons were superior to those of the Prussians.[33]

Accordingly, the Prussians devised a two-staged artillery employment tactic. In the first phase, artillery was massed as the Confederates did at Gettysburg. At Sedan, the Prussians/Germans massed 540 guns into one large firing unit. This grand battery then bombarded its French counterparts at extended ranges from which the French could not fire back. Once the enemy artillery was destroyed or driven off, the Germans shifted the artillery into the second phase. Whereas phase one was centralized, phase two was decentralized. The large battery was broken up and pushed forward in small units to support the attacking infantry. While the artillery suffered casualties, it successfully supported the German infantry, negating the French rifle advantage. At Sedan, the Germans decisively defeated the French and forced Napoleon III to surrender. While technological innovations negated many of the lessons of the Franco-Prussian battles, the mass tactics soon resulted in the creation of permanent artillery units above the battery level in European armies. Army corps soon had permanent artillery brigades with subordinate regiments and battalions.[34]

In the years before the United States entered World War I and even after the war had begun in Europe, US Army field artillery improved itself technically with improved weaponry and gunnery techniques. However, tactically, training still focused on its traditional role of providing small, light cannons to support groups of infantry at close range. Instead of true combined arms, with the artillery supporting the maneuver of the infantry with continuous fire support, such fire was still direct. The infantry and artillery in essence fought separate battles. Even after European field artillery adopted new techniques during the war, including massed indirect fire, US field artillery remained fixed tactically in the previous century. European developments during the war, however, created modern field artillery. By the end of the war, battery organization and fire control techniques were much as they would be for most of the modern period.[35]

At the start of World War I, European field artillery resembled the American's in employment. Cannons designated to support the infantry were of small caliber, 77-mm for the Germans and 75-mm for the French. The designers of the French 75-mm field gun, which had been introduced in 1897, made it so that gun recoil did not disrupt the weapon's placement, allowing it to fire rapidly without having to be re-aimed between shots. The

Germans upgraded their lighter 77-mm field gun to the French standard before 1914.[36]

Organizationally, both sides fielded large field artillery forces to support their armies of massed infantry. The French alone deployed 1,000 four-gun 75-mm batteries, an average of four-gun tubes per thousand infantrymen. A 1914 German infantry division fielded a six-gun 77-mm battery for each infantry battalion. French divisional artillery consisted of 24 75-mm pieces or 0.75 batteries per infantry battalion. National doctrine for the use of these guns differed.[37]

In general terms, the Germans stressed firepower, while the French favored mobility. German divisional and corps artillery included a number of heavier guns of 105-mm and 150-mm calibers. French offensive doctrine so favored light, mobile pieces that there were no heavier pieces below the field army level in the French order of battle in 1914. The French 75s could fire faster than the German equivalents, but the Germans fielded a mix of lighter and heavier pieces that could fire for a longer range and with more lethality. Additionally, German light artillery was organized into six-gun batteries. In 1914, a German division contained 72 field artillery pieces, while the equivalent French organization only had 24.[38]

The Germans had also developed the coordination of field artillery with infantry at a higher level than the French. Senior artillery commanders, usually at the division level, controlled massed batteries whose employment was planned to support the infantry's most important efforts. While their doctrine stressed offensive operations and the use of artillery in an auxiliary role to infantry, the French concept of the offensive meant that field artillery was expected to be used primarily to support attacking infantry. The French expected to employ their 75s in close combat using direct fire, under the control of infantry commanders. Anticipated battlefield fluidity prevented any detailed or extended artillery fire employment planning.[39]

These differences in doctrine and weaponry were sharply seen in the opening campaign of 1914. When suddenly on the defensive, some French divisions found themselves ill-equipped to use their artillery. For example, in the key Battle of Charleroi on 21 August 1914, where the Germans stormed across the Sambre River and preempted an attack of the French Fifth Army, the French division that received the brunt of the German attack, the 5th Infantry Division, with no infantry attacks to support, left its artillery unused and uncalled for, out of range behind its infantry. A week into battle, some batteries had not even fired once, even though the division had been in almost continuous action.[40]

This was not unusual. The general pattern for the opening campaign was that the French guns, despite being faster to fire and more accurate, were usually not in a position to fire on the enemy, while the German artillery was both able to outrange the French artillery and mass and place fires where they best supported the overall plan of the supported unit. One German frontline artillery battalion commander reflected that, while he was free to fire at visible enemy targets within range, as a general rule the enemy artillery was never seen. The Germans, as did the French, fired directly at enemy targets, often in front of the infantry, but rarely over their heads.[41]

The German advance exhausted the infantry and overextended communications lines and artillery supply. The Allies, having fallen back on their own lines of communications, took advantage of the German lack of coordination and counterattacked. At the First Battle of the Marne, the French artillery found itself in the position of supporting attacking infantry. For the first time in the war, the French artillery proved itself and the 75-mm gun gained its reputation. For the French 5th Infantry Division, its 75s effectively pounded the German defenders supporting a two day action around the town of Courgivaux (6–7 September 1914). The Germans then retreated for 5 days to prepared defensive positions along high ground north of the Aisne River. Along this new line, static trench warfare developed and with it an enhanced role for field artillery where firepower was far more important than mobility.[42]

When used properly, artillery had proven to be devastating in the opening campaigns of 1914. However, the reason the front lines soon became static was the intensity of infantry firepower, primarily in the form of machineguns. For the rest of World War I, field artillery became the most important weapon at the disposal of commanders to try to overcome infantry firepower. On the defense, it could break up attacks. On the offensive, at least until proven otherwise by field experience, commanders expected massed artillery barrages to destroy enemy defenses. These barrages gradually expanded in duration before attacks.[43]

Modern artillery procedures developed during the war. The most important of these was indirect fire. The early campaigns of 1914 had shown the vulnerability of field artillery deployed too far forward. The British lost all the artillery of a division at Le Cateau, and the French and Germans suffered heavy cannon casualties at Bertrix in the Ardennes.[44]

The adoption of indirect-fire gunnery techniques provided a solution to the need to deploy field artillery in depth where it could survive out of the range or observation of enemy direct fire. Indirect-fire gunnery was the application of geometry and ballistics factors to targeting information provided by observers located near the front line rather than at the battery position. The technique was known before 1914, and both sides used it extensively in the Russo-Japanese War. American observers of that war had foreseen the future dominance of indirect fire. The Germans also considered the use of indirect fire with its heavier field artillery pieces. This capability was, however, not used in the field until the front became static.[45]

The limitations presented by the various communications means available to link the observer with the guns were the major disadvantage of indirect fire. In direct fire, the battery commander could direct the fire via voice commands or hand signals. Indirect fire depended on an observer connected to the battery by radio or field telephones. Radios in 1914 were unreliable and not portable. In the Marne campaign, the German High Command had great communications difficulties while depending on radios to communicate to subordinate armies. Field telephones worked well in stationary operations. But in activities where the units were constantly advancing or retreating, the telephone, depending on the stringing of lines of wire, was more problematic.[46]

Since all sides in 1914 expected to fight in mobile operations, the artillerymen and their infantry commanders considered indirect fire to be impractical. However, after the battle lines became static, the observer could link with the battery using semipermanent field telephone lines. Indirect fire allowed the deployment of batteries in covered terrain and in depth. All combatants soon adopted the technique, and all combatants almost universally used indirect fire, with gunnery techniques becoming increasingly more sophisticated as the war progressed. By mid-1915, the combatants were placing their supporting artillery between 2 and 3 kilometers behind the frontline trenches, between infantry regimental command posts and the divisional command post.[47]

Infantry firepower in the form of the machinegun, coupled with the lack of battlespace for operational maneuver, had stopped effective offensive action on the Western Front by the end of 1914. As the front became stationary, field artillery for the first time became a full partner in the combined arms. Static defensive operations practically depended

on centralized artillery firepower for its success. Field artillery became a fully integrated component of the combined arms team, not only on the defensive but also on the offensive.[48]

Even before the primacy of positional war, artillery had been considered essential to all attacks. After their brief repulse at Mons at the hands of the British during the opening campaign in Belgium, where the German infantry attacked with minimal artillery support, the Germans always preceded their assaults with a deliberate artillery bombardment. The French, too, came to this realization from trial and error. After numerous assaults with less than maximum artillery support, French division commanders soon too refused to attack without a preliminary artillery bombardment. Such a preparation became official French policy as early as November 1914. By 1915, French infantry would not assault single buildings unless artillery had already flattened them.[49]

Between late 1914 and late 1917, most attacks failed or, at best, achieved only limited successes. For the most part, the Allies attacked and the Germans, except at Verdun in 1916, defended. These overall tactical and operational postures, coupled with available stockpiles of cannons and supplies of ammunition, resulted in two basic theories on the use of artillery firepower—destruction and neutralization.

The destruction theory of firepower developed in the Allied camp from battlefield experience primarily in 1915. In this period, Allied attacks generally failed in the face of German artillery and machinegun fire or, at best, resulted in extremely limited success. From such battles as Neuve-Chapelle in March 1915, the Allies drew the conclusion that artillery firepower had to destroy all enemy resistance in front of the advancing infantry. The establishment of extensive preliminary bombardments and a heavy rolling barrage in front of the attacking infantry was the natural result of such theory.[50]

The French and British could not match the intensity of German firepower. Throughout 1915, the German artillery remained superior to those of the French and British. The Germans, having expected in the prewar period to assault fixed fortifications in Belgium and France, had more guns of higher calibers. They also employed higher caliber howitzers that were more effective in the indirect-fire mode because of their characteristic high trajectory. The French and British solutions to this disparity were longer bombardments.[5] However, longer bombardments sacrificed operational surprise. The Germans were routinely alerted to the area of attacks and able to mass troops either to repulse or as counterattacking reserves.

The Allies responded with even larger bombardments considered to be irresistible. Artillery firepower was expected to systematically destroy the German position. Throughout 1915, French bombardments expanded up to 6 days. At the Somme in 1916, the bombardment extended to 7 days. At Messines Ridge beginning the 1917 Passchendaele offensive, the British fired a 21-day bombardment. The brute strength of this bombardment effectively destroyed the German counterbattery artillery and brought about such destruction on the ground that the infantry merely had to occupy the destroyed German forward positions. As the Germans, well aware of where the assault was coming and somewhat shattered by the explosion of a series of mines under their position, merely withdrew to positions in depth.[52]

While such bombardments destroyed all pretense of operational surprise, a further enhancement of Allied technique destroyed tactical surprise as well. With bombardments extending for days and weeks, the German defenders could not be sure when the artillery fire would end and the attack would begin. However, at the Somme, Allied artillery fired an intense final bombardment right before the infantry assault aimed at destroying machinegun positions. This tipped the Germans off to the imminence of the attack at the tactical level.[53]

The failure of destruction was as much a property of the inherent dispersion of indirect artillery fire as it was the ability of the Germans to adapt to such techniques. Indirect field artillery was and is, by its nature, an area fire weapon. Its fire could disrupt or temporarily neutralize the enemy. Long-term bombardments could increase the neutralization effect almost up to destruction levels. But, at the same time, they warned the enemy and destroyed the ground over which the infantry would have to advance.[54]

As Allied bombardments got longer, the Germans did not initially change their defensive posture to lessen the effects. It took several years and the massive artillery barrage at the Somme to eradicate the long tradition of steadfastly holding onto defensive positions. Although the British offensive at the Somme stalled, the Germans suffered great casualties by having troops massed in the front line. When the team of Field Marshal Paul von Hindenburg and General of Infantry Erich Ludendorff took control of German operations in mid-1916, Ludendorff immediately initiated an effort to develop new, more effective defensive tactics.[55]

The result was the publication of a new doctrinal manual on 1 December 1916, which transformed German defensive tactics. The defense shifted

from a linear one with most of the defenders in the forward-most trenches to one arrayed in depth. No longer would ground be held at all costs. The Germans would retain the initiative while on the defensive using rigorous, multiecheloned immediate counterattacks.[56]

The new doctrine also emphasized the best use of terrain. Wherever possible, the defense would occupy positions on reverse slopes that obscured the positions from enemy observation. In places where the Allies held superior observation, the Germans simply withdrew to positions that favored them. Thus, defensive positions maximize the use of artillery by providing excellent surveillance for the defenders and inferior observation for the attackers. The best example of this was the withdrawal in the spring of 1917 from a large salient in the center of the Western Front to prepared positions referred to by the Allies as the Hindenburg Line. The Hindenburg Line was specifically sited based on artillery considerations first and foremost.[57]

By 1918, the Allies, too, had generally adopted the defense-in-depth concept as a response to German infiltration tactics and its accompanying artillery neutralization tactics. At Reims in July 1918, the French Fourth Army repulsed the German attack, while the front of its neighbor to the west, the French Fifth Army, collapsed while using the more traditional defensive tactics. This was the last German offensive success of the war.[58]

The importance of artillery in Allied attacks became such that, as the war progressed, the theory of destruction reversed the traditional relationship between the field artillery and infantry. In many ways, the infantry was now advancing in support of the effects of artillery firepower. Since a predetermined timetable determined the artillery's rolling barrage and was conducted against a line of targets parallel to the line of advance, infantry at the Somme had to advance in a line and at the pace of the artillery's advance. If successful, the artillery would lead the infantry onto its objectives.[59]

The range of the artillery now determined the depth of the battlefield as well. Objectives were tailored to be within artillery range throughout the attack, limiting operations to geography compatible with the technical characteristics of the guns and how long it would take them to use up stockpiles of ammunition.[60]

Destruction, however, proved to be an ineffective solution. In the Battles of the Somme in 1916 and Passchendaele in 1917, the destruction proved to be incomplete even though the Germans suffered heavy casualties in their frontline positions. At Messines Ridge at the start of

the Passchendaele offensive, massed British artillery destroyed almost 50 percent of the heavy German artillery while forcing the rest to withdraw after an extensive artillery duel. The artillery positioning had tipped the Germans off as to the location of the attack, and using their new defense-in-depth tactics, they withdrew allowing the British to take their limited objectives while the Germans suffered minimal infantry casualties. Accordingly, the massed British artillery successfully destroyed the defending artillery but could not destroy the enemy infantry.[61]

Despite their early advantage in having heavier artillery, the Germans took a different approach to artillery firepower. After the Western Front solidified as a continuous line from Switzerland to the sea by the end of 1914, the German High Command, faced with fighting a two-front war with a weak ally in the east, meant that the Germans could not mass sufficient forces for offensive operations in 1915. With the British maritime blockade causing materiel shortages, the German High Command extended this defensive posture to early 1918, with a brief hiatus for limited offensive operations at Verdun in 1916.

Unwilling to give up tactical or operational surprise and viewing offensive artillery operations from the more open spaces of the Eastern Front or in a counterattacking role, the German Army developed the concept of neutralization instead of destruction. Under the theory of neutralization, artillery support did not become a power of its own. The fire of the guns was tailored to the planned maneuver of the infantry. Instead of having to destroy the enemy artillery and machineguns, the German artillery would fire to disrupt the defenders from hindering the German advance. The initially heavier German guns assisted in this process by being able to apply greater firepower over shorter bombardments than the Allies could. Such a use of artillery, as with the Allies, required a detailed timetable. But the Germans were more flexible in changing the timetable based on battlefield realities.[62]

For the Germans, the 29–30 October 1914 Battle of Vailly was a watershed for their artillery employment. There along the banks of the Aisne River, the German III Corps conducted the first successful attack since the defeat at the First Battle of the Marne 6 weeks earlier. It was the first successful German attack against entrenched enemy infantry. Artillery usage at the battle showed the differences between German and Allied artillery employment and philosophy. The corps commander realigned all his available artillery under a single artillery commander. The key factor in the success was the ability of the German infantry to advance before the French had recovered from the effects of the German barrage.[63]

To achieve this, the Germans first retained surprise by pausing their preliminary bombardment four times before the actual assault. When the bombardment actually ended, the French responded slowly in resuming their positions in the forward trenches. Any enemy casualties in the initial bombardment were a bonus. The purpose of the bombardment was, however, not to destroy the enemy position but, rather, to neutralize it by forcing the defenders to take cover. If the German infantry conducted a rigorous advance timed to begin immediately after the last artillery pause, it stood a good chance of seizing major portions of the French frontline trenches with minimal casualties. At Vailly, in most places, the Germans were successful. Neutralizing the enemy defenders with artillery fire timed closely with infantry maneuver became the standard German technique throughout the war.[64]

However, the Germans, too, could not escape the importance of artillery to the infantry. The German commander at Vailly limited the advance to the range of the supporting artillery because he feared a French counterattack while the German infantry was vulnerable if its supporting artillery had to move forward to support a longer advance. The inability of being able to move reserves forward to continue the impetus of a successful attack was a continual problem for World War I armies at both the tactical and operational levels.[65]

After the lines solidified, the Germans maintained their advantage in heavy guns for most of the war. However, this was offset by supply difficulties and a need to remain on the defensive in the west for most of the war. On the defensive, neutralization principles applied similarly as on the offensive. The Germans relied on strong immediate infantry counterattacks supported with artillery fire aimed at neutralization of the former attackers.[66]

After some successes in the east, the Chief of the German General Staff, General of Infantry Erich von Falkenhayn, adopted an indirect operational version of the Allied destruction theory at Verdun in 1916. Falkenhayn believed that German artillery superiority, as demonstrated at the May 1915 Battle of Gorlice-Tarnow against the Russians, could be applied to the more narrow confines of the Western Front. If the Germans could threaten the French fortress at Verdun, Falkenhayn reasoned, the French would fight to the death to defend the city as a matter of national honor. The German artillery could then use its firepower to destroy the French attacking forces.

Gorlice-Tarnow was a much larger version of Vailly. The Germans centralized artillery fire during the preparatory phase, but decentralized it during the ground assault. Artillery and infantry command posts collocated. The preliminary bombardment was short—between 4 and 6 hours, excluding two false pauses. After the artillery fire shifted to the rear away from the Russian front line, the German infantry raced across no-man's land with minimal casualties and assaulted the Russian trenches with bayonets. In some cases, the Germans were in the Russian trenches less than 5 minutes after the artillery preparation shifted.[67]

The result was a collapse of the Russian position, with mass surrenders or flight. The Germans and their Austro-Hungarian allies achieved a major operational breakthrough. Before the front solidified again, the Central Power forces had cleared most of Poland of Russian troops and had captured 140,000 enemy prisoners.[68]

Falkenhayn realized that the Western Front was too dense and narrow to repeat the breakthrough aspects of Gorlice-Tarnów. However, he felt the stunning power of the German artillery could be applied selectively to bleed the French dry at Verdun. Attrition, rather than the seizure of ground, was the objective. Verdun was a perfect choice for the operation. Not only would the French fight tooth and nail to defend the fortress, but it was also located in a salient pointing into the German lines. Artillery could fire on the French from three directions.[69]

The key to getting the French to take the Verdun bait was initial German success. Falkenhayn massed 1,612 artillery pieces around the salient. To maintain surprise, the artillery preparation, unlike contemporary Allied ones, was only 10 hours long rather than a week. The initial assault infantry and specialized engineers moved up close behind the barrage and immediately rushed the forward French trench line when the barrage shifted. The assault was initially successful although the fortress of Verdun, an anticipated objective, did not fall. However, the threat of its fall resulted in the French response that Falkenhayn had wanted. The French soon committed large forces both to save Verdun and to push the Germans back.[70]

However, there was a major disconnect in the German command. While Falkenhayn sought to suck the French into a trap, this necessitated the Germans not falling into the attrition trap themselves. However, his subordinates in the field were soon falling back into tactics stressing the taking and holding of ground. Such tactics exposed the German infantry to

the firepower of the French artillery. Accordingly, by the time the Germans called off offensive operations at Verdun in July 1916, they had suffered losses of a proportion only two-thirds less than those of the French (roughly 400,000 to 266,000). Falkenhayn lost his position to the team of Hindenburg and Ludendorff. Hindenburg and Ludendorff developed or supported the further development of artillery tactics of neutralization in conjunction with defense in depth and the use of infantry infiltration tactics on the offensive.[71]

Falkenhayn had applied the destruction theory at the operational level. As at the tactical level, infantry operations focused on placing the artillery in a position where it could batter the enemy artillery. But by 1917, the pendulum began shifting back toward the artillery supporting infantry maneuver rather than the infantry following up on the effects of artillery firepower. Except at Verdun, the Germans had never really abandoned this concept. But, starting in 1917, they continued to refine infantry-artillery cooperation. The Allies soon followed suit.

As early as 1915, the Germans had collocated infantry and supporting artillery headquarters. This was not enough, however, to provide battlefield flexibility at the lower levels. Both the French and Germans soon developed the concept of the artillery liaison officer (ALNO), who was an artillery officer with no command responsibilities to any particular artillery unit. The ALNO's primary responsibility was to coordinate between the infantry and its supporting artillery. The Germans maintained an ALNO at each infantry battalion command post. Although communications difficulties often made infantry-artillery coordination difficult, the use of ALNOs was an effort to address paradoxes that had occurred in the command relationships between artillery and infantry—the artillery was supposed to support the infantry; the infantry was not supposed to blindly act in accordance with the artillery fire plan.[72]

As part of the December 1916 shift in their tactical doctrine, the Germans further advanced this concept through the creation of the frontline commander, or *Kampftruppenkommandeur* (*KTK*). The *KTK*, usually the frontline infantry battalion commander, had complete authority over all the combat power in his sector of the front. This included all artillery support. The *KTK* retained command of his sector during an action even if he were reinforced with other battalions and general support assets and counterattacking forces. Infantry regimental commanders, accordingly, retained purely an administrative and logistical role in such situations. Under the new German system, one commander was in charge and made the determinations over the use of artillery. This commander had an

ALNO at his disposal to facilitate these determinations. Problems such as the Hunt-Hancock controversy, therefore, did not take place.[73]

Despite these refinements, the firing timetable remained the most important tool for facilitating infantry-artillery coordination. The inflexibility of using the timetable reflected the communications means of the day. While the combatants, especially the Germans, tried to make their artillery more flexible and responsive to combat conditions, it was difficult short of bringing the artillery forward with the infantry.

This concept was, in fact, universally tried in World War I. The so-called "infantry guns" were usually a battery-size artillery unit attached directly to an infantry battalion or regiment on the attack. The infantry guns of this era were generally used to fire directly at point targets such as bunkers and machinegun positions. For portability, generally smaller weapons were used, more reflective of the latter class of antitank guns. The Germans began replacing cannons in this role with small mortars (*Minenewerfer*). The Allies later adopted mortars as a weapon found in French infantry regiments and US infantry divisions.

In terms of the successful use of field artillery in the offensive, no man was more important than German Colonel Georg Bruchmüller in 1917–18. After early notable successes in the east, Bruchmüller became an artillery fireman, being shifted around to command the artillery in all the major German offensives in 1918. He refined earlier German artillery techniques that emphasized surprise and quick infantry assaults by organizing the artillery to fit its missions. Bruchmüller organized his guns into three functional groups, each devoted to specific missions. All had the goal of neutralization rather than destruction and supported the ground attack.[74]

In this tailoring, Bruchmüller used the standard field artillery divisional, regimental, and battalion headquarters staffs to command the functional groups. Starting in 1916, the Germans had streamlined their organizational structure, including the field artillery. This reorganization facilitated the tailoring of the guns for specific missions. In the division, a divisional artillery command, or *Artilleriekommando* (*ARKO*), replaced the former brigade. The *ARKO* contained a field artillery regiment with nine batteries of light guns (six of 77-mm field guns and three of 105-mm howitzers) and a heavy artillery battalion with two batteries of heavy 150-mm howitzers and one of 100-mm field guns.[75]

At corps level, there was no permanent artillery command. But the corps usually contained an artillery regiment with two heavy battalions earmarked for counterbattery fire and additional heavy artillery units

attached as necessary. By the end of the war, German field armies and army groups had a chief of artillery, the position typically held by Bruchmüller. However, these commands were only assigned artillery assets as needed from the High Command's General Artillery Reserve, which managed this asset in a centralized manner.[76]

The first of Bruchmüller's functional groups was the infantry assault group, or *Infanteriebekämpfungsgruppe* (*IKA*). The *IKA*, usually commanded by *ARKO*s and reporting to their division commanders, consisted of approximately three-fourths of the available artillery. Although available for other missions if necessary, the *IKA* supported the infantry, firing the barrage into the frontline positions and in front of the assaulting forces. The *IKA* pooled light field guns and howitzers.[77]

The remaining artillery was divided into two elements. The first of these, about one-fifth of the total, was the counterbattery group, or *Artilleriekämpfungsgruppe* (*AKA*). The *AKA* was typically commanded by the artillery commander of a division in reserve and fell under the corps commander. The *AKA*'s main mission was to place fire on the enemy artillery positions. It primarily assembled heavy field howitzers from the divisional battalions and regiments attached to the corps.[78]

The remaining relatively small group was the long-range group, or *Fernkampfgruppe* (*FEKA*). Leading the *FEKA* was usually one of the artillery regimental commanders who also reported directly to the corps. The *FEKA* pooled the longest ranged heavy and field guns in the command's artillery. Its targets, usually fired by map spotting, were distant command posts, telephone centers, and other installations within range of the guns.[79]

As part of the infantry gun concept, apart from these groups, Bruchmüller assigned a four-gun artillery battery (*Infanteriebegleitbatterie* (*IBB*)) to accompany each assaulting infantry regiment. These batteries came from the division artillery.The *IBB*s followed the first assault wave roughly 1 kilometer to the rear with the second wave and provided artillery fire to targets of opportunity and immediate artillery support as the assault echelon moved beyond the range of the supporting artillery. In addition, a specialized assault artillery battery (*Infanteriegeschützbatterie* (*IGB*)) was attached to each assaulting division. The *IGB*s were divided up and parceled out as individual guns, one per each infantry battalion in the assault echelon, where they were part of the first assault wave.[80]

The *IKA* and *AKA* were further subdivided into two major subgroups (*Untergruppen*) under artillery regimental headquarters. Each *Untergruppe*

and the *Untergruppe*-size *FEKA* were further divided into several minor subgroups (*Unterverbänden*) under artillery battalion commanders. While the *Untergruppen* consisted of a mix of weapons, the *Unterverbänden* usually contained batteries equipped with the same weapon. Each subgroup had a specific sector of fire.[81]

Bruchmüller employed these tailored groups in a detailed three-to-five phased preparatory fire that alternated between attacking the front line and counterbattery fire in which gas rounds and high-explosive rounds were used. The shifts away from the front line were designed to bait the enemy infantry forces into returning to their positions in time for the next phase of attack against the front. The whole preparatory bombardment was typically less than 5 hours, but it was intense.[82]

This was immediately followed by the rolling barrage and the infantry advance. The advance was expected to go to a depth of 6 or 7 kilometers, deep enough to push through the enemy's primary defensive line and its field artillery positions. If the advance was successful, Bruchmüller then began moving batteries forward as they ran out of range. With the front broken through, the artillery reverted to its conventional organizational structure.[83]

The Bruchmüller method, while primarily designed to neutralize the enemy artillery and infantry, also contained elements of destruction and deception. For added flexibility, independent teams of artillery noncommissioned officers and junior officers equipped with field telephones advanced with the leading infantry and provided artillery fire to targets of opportunity that had survived the effects of previous fire.[84]

Starting in late 1917, the Germans combined Bruchmüller's methods with nonlinear infantry "infiltration" tactics and initially gained great success in a series of offensives, including battles at Riga, Cambrai, and all of the major German offensives of 1918, starting with the attack at Saint-Quentin in April 1918. These attacks were initially operational-level successes, although all eventually petered out because the Allies could rush reserves to the threatened front faster than the Germans could advance.

Additionally, the Allies adapted to the German tactics, primarily by adopting a defense-in-depth posture. In the fifth and last German offensive in their 1918 series at Reims in July, the Germans attacked the French Fourth and Fifth Armies. The Fifth Army defended in the usual style, with the defense forward, including the bulk of the artillery. In that sector, the Germans and Bruchmüller had their usual initial success until the Allies massed against the newly created German salient and pushed the weak German forces left in the salient back to their original positions.[85]

But in the Fourth Army sector, the French commander adopted a defensive posture similar to the German defense in depth. The main line of resistance (MLR) was placed not in the front line but up to 4 kilometers to the rear of the forward positions, almost out of German artillery range. The bulk of the French artillery was behind the MLR as well. The Germans, including Bruchmüller, did not realize this change and attacked as usual. The first sign of trouble was when the Germans lost tactical surprise through intelligence gained from prisoners and the French immediately fired an intense 40-minute counterpreparatory bombardment, which was effective against the German infantry massing for the assault because the French gunners did not have to fear fratricide as the nearby French trenches were unoccupied.[86]

The German attack, including Bruchmüller's five-phased preparatory fires, went off as scheduled. However, this fire was ineffective because it landed on unoccupied positions. The Germans advanced into the forward French positions with ease, but the Fourth Army had placed its outpost line behind these forward trenches. The outpost positions survived the rolling barrage and successfully separated the advancing German infantry from the rolling barrage. The German advance slowed as the barrage was not available to neutralize French strongpoints and the infantry had to use its own weapons to silence them. Additionally, the Germans were advancing within range of the undamaged French artillery. When the French MLR was reached, the Germans did not have the firepower and maneuver advantage necessary to obtain a breakthrough. The attack had faltered and was called off after less than 24 hours when the French counterattacked. The Germans had failed to break through the French MLR.

This was Bruchmüller's first defeat as an army-level artillery commander. A combination of defensive techniques, including good intelligence and counterintelligence, and depth of position had beaten Bruchmüller's formula. The Germans never resumed the initiative for the rest of the war. When the tide turned against the Germans in mid-1918, Bruchmüller's usefulness as a breakthrough specialist waned, and he spent the last months of the war as the artillery chief of the German field army opposing the American attack in the Argonne Forest.[87]

Reims was the first Allied success against the Bruchmüller method, but the Allies had begun developing their own techniques as early as the spring of 1917 at Messines Ridge. In October 1917, the British conducted an experimental attack at Cambrai, designed to test the battlefield effectiveness of using massed tanks. Since the British wanted to stress surprise and not tear up the terrain (which had not previously been

contested as it was in a sector into which the Germans had retreated earlier in the year), they employed nonconventional artillery tactics.

These included no British preliminary bombardment. The shock and surprise of the tanks would carry the German positions instead. The subsequent barrage depended on intensive (hurricane) map-spotted (called by the British predicted) fire. The British attack was initially highly successful. However, the Germans ultimately recovered and counterattacked, successfully using their new infiltration tactics to great effect. As part of the counterattack, Bruchmüller arrived from the east as an artillery observer. One of the corps in the German counterattack was the first unit to employ a Bruchmüller-style preparatory fire on the Western Front.[88]

When the Allies returned to the offensive in July 1918 after surviving the German strokes of the first half of the year, their preparatory fires were universally far shorter than in the pre-Cambrai era and increasingly stressed tank support and counterbattery fires. American artillery played a large role in the successful offensive operations of the second half of 1918. While artillery had long been a formidable arm (it is not a coincidence that the Army's official song came from the field artillery), for the United States Army, World War I was the turning point to fielding a modern field artillery force, which was both much larger and organized to a higher level than ever before.[89]

The United States entered the war on the Allied side in April 1917. It would not be until mid-1918 that US forces appeared on the Western Front in large numbers. Accordingly, American organization and doctrine was able to adopt all the lessons the Allies and, to a lesser extent, the Germans had learned in the first 3 years of the war. After extensive deliberation throughout 1917, the American Expeditionary Force (AEF) fielded an organization based on these lessons in 1918.[90]

The artillery of the new American infantry divisions consisted of a brigade headquarters with two regiments (48 cannons) of 3-inch (76.2-mm) guns (or French equivalents), a regiment (24 cannons) of 6-inch (152.4-mm) guns (or French equivalents), and a battery of 58-mm trench mortars. The 3-inch guns provided direct support to the infantry with a field artillery battalion of 12 guns supporting each infantry regiment, with the 6-inch guns and trench mortars being in general support. At corps level, the AEF deployed a brigade of field artillery equipped with a 4.7-inch (120-mm) gun regiment and a 6-inch (152.4-mm) howitzer regiment, and a 240-mm trench mortar battalion. At field army level were four brigades,

each with three 6-inch howitzer regiments. Tactical commanders at each echelon determined how the general support and higher echelon tubes would be used based on the ground tactical plan.[91]

The American military adage that the "artillery is never in reserve" originated in World War I. Accordingly, divisional artillery brigades and subordinate units frequently were detached to support other units. When the AEF proved to have a faulty replacement system, some divisions were broken up for this role. But the artillery brigades of such divisions were retained with a combat mission and, when fully trained, detached to corps headquarters or to other divisions. Despite fielding eight corps in the AEF, the Army only created three corps artillery brigades. The AEF used brigades from the skeletonized divisions and, at times, divisional brigades in this role. The net result of this organizational discord was that units often went into combat with direct support artillery units they had not previously trained or fought with.

An example of this is the experience of the 32d Division, a former National Guard unit composed of troops from Florida, Georgia, and Alabama. When the division arrived in France in February 1918, it became a depot division. Its organic field artillery brigade, the 57th, was detached from the division. Except for a 2-week period in June 1918, the brigade never returned to division control. In April 1918, the division, without its artillery, was converted back to a combat unit and entered combat in a quiet sector in June. From July to the end of the war in November 1918, the division participated in all the major AEF campaigns. During this period, the division received artillery support from a variety of French and American divisional artillery. In its first 17 days in the Meuse-Argonne offensive, a succession of divisional artillery brigades from four other divisions supported the division. One of these divisions was in reserve, another was skeletonized, but the other two were, in turn, also supported by nonorganic artillery.[92]

In addition to organizational difficulties, in terms of artillery, US forces had a basic doctrinal problem. While the Army created units based on trench warfare conditions, the AEF commander, General John Pershing, firmly believed that trench warfare was only a temporary condition. US units had to be ready to fight under open, mobile warfare conditions as well. Accordingly, Pershing forced his subordinates to train for both kinds of warfare. Lessons of artillery employment and technique, in particular, were considered incompatible between the two modes, and American field artillery became adept at indirect fire, particularly map-spotted targeting. The American experience in the war was relatively short and

primarily offensive in nature, although all under trench warfare, not open, conditions.[93]

American planners nevertheless stressed infantry-artillery coordination in trench warfare conditions. This was primarily done by placing large artillery liaison teams with each infantry regiment and using detailed planning and predetermined maneuver and firepower schemes. The timetable, given communications capabilities in 1918, was the only effective means to coordinate infantry and artillery actions. The artillery liaison teams were, therefore, tasked with fire planning rather than adjusting fires after an action had started.[94]

At the first American action in the war, Cantigny, the artillery fire plan resembled, to a great extent, Bruchmüller's functional, multiphased schemes. Reinforced with French heavy artillery, the artillery brigade of the US 1st Division fired an intense 1-hour preparatory bombardment. Five minutes before H-hour, the rolling barrage began along with a concurrent counterbattery bombardment of a mix of high-explosive and gas shells designed to neutralize the German artillery. The German guns were quickly suppressed, and the lead US infantry regiment quickly captured Cantigny against resistance weakened from the artillery fire and without is own artillery support.[95]

After being repulsed at Belleau Wood without artillery, the US 2d Division fired a 24-hour barrage before the final assault, which took the woods. However, most American preliminary bombardments were far shorter. At the beginning of the largest American operation of the war, the Meuse-Argonne attack, which began on 26 September 1918, American gunners fired a 6-hour preparation. Subsequent barrages were 2 hours or less long.[96]

Immediately after the war, a Kansas politician claimed that lack of both artillery and aerial support had cost the 35th Division, the Kansas-Missouri National Guard division, more than 7,000 casualties in 6 days (26 September to 1 October 1918) of battle in the Argonne Forest. The division was withdrawn from the Argonne and spent the rest of the war either in reserve or along a static sector. This public outcry showed that combat experience, especially in a technical arm such as the artillery, was significant.[97]

Ironically, the division's 60th Field Artillery Brigade was in support throughout the 6 days. The 35th Division participated in the opening of the Meuse-Argonne offensive where the artillery was initially handled poorly. The preplanned rolling barrage, paced to an advance of 400 feet per

minute, ended up getting far ahead of the infantry. Only high-explosive, not gas, rounds were fired out of fear of German reprisals. The Germans fired gas rounds anyway. Armywide, the artillery was ineffective in the opening stage of the offensive.[98]

For the 35th Division, the situation was even worse. The division's French 75-mm guns fired slowly—1 or 2 rounds a minute, whereas the guns could fire, at least for short periods, 30 rounds a minute. The guns were also placed too far to the rear, necessitating a move forward on the afternoon of the first day. This move was not smooth—the guns became caught in a traffic jam that left the forward infantry unsupported for hours.[99]

The artillery woes continued throughout the 35th's 6 days of combat. On the second day, only one artillery battalion was in position to support the continuance of the attack, with rugged terrain and obstacles hindering forward movement. Without artillery support, the division attack failed. A second attack in the late afternoon, with the artillery now in position, was more successful. However, the Germans recovered, and on the third and fourth days, 35th infantry attacks gained little ground. On the fourth day, the artillery fired totally uncoordinated from the maneuvers of the infantry. This meant the main divisional attack moved forward without artillery fire. German defensive fires decimated the regiment, already down to less than 500 soldiers. In addition, the Germans committed three squadrons of close air support aircraft into the battle against the attacking American infantry. The remnants of the division fell back to a line to the rear built by the division's engineer regiment. The division in its weakened state was saved from a possibly fatal German counterattack when, finally, there was artillery support. A total of 31 batteries were massed to cover the withdrawal to the new line. Two days later, the division was relieved from the front line.[100]

While the 6 days in the Argonne created a postwar political crisis in Kansas, the cause of the 35th Division's debacle was not a scandal over a shortage of horses or artillery. The division had its organic artillery with it, with its equipment. What the division lacked was battle experience. After spending several months in quiet sectors, this was its first offensive combat. While many American divisions were in the same condition, and the first army barrage overall was ineffective across the board at the beginning of the Argonne battle, weak divisional and division artillery brigade commanders further hindered the 35th Division.[101]

Within a month, American artillery skill had improved exponentially. The most effective US preliminary bombardment of the war was its last,

that conducted by the First Army on 1 November 1918, beginning the final phase of the Meuse-Argonne attack. The barrage was the culmination of American wartime artillery experience. On a 15-mile front, the First Army massed 1,538 guns and howitzers. The preliminary bombardment was only 2 hours. Each attacking division had a double allotment of artillery, and the guns were positioned forward to maximize the ability to support the infantry advance. Pieces fired between 10 and 12 rounds a minute. Gas shells were mixed with high explosive. The result was the closest thing the US Army came to Pershing's concept of open warfare. The artillery proved to be decisive with one division advancing 5 miles the first day. By the end of the second day, the attack had created a breach in the German defenses 10 miles wide when a German division disintegrated. Soon, the American advance reached pristine terrain yet untouched by wartime ravages. The use of gas forced the Germans to withdraw from key terrain, turning the last few days of the war into a virtual pursuit operation, with daily advances of 4 to 5 miles. The advance reached the Meuse River just south of Sedan by the time the Armistice ended the fighting.[102]

A unique feature of American artillery operations in World War I that would become controversial in the interwar period was the idea of infantry guns. Similar in concept to Bruchmüller's *IBB* and *IGB*, two divisional field artillery battalions were usually earmarked to be under direct infantry control in the attack. A battalion of three batteries each was detached to each divisional infantry brigade. The brigade, in turn, placed a battery each with its two infantry regiments as "infantry guns." The third battery was divided up as individual gun sections and assigned separately as "accompanying guns," with the leading infantry battalions. The employment of accompanying guns was to fire directly at point targets in front of the infantry advance.[103]

World War I was the advent of modern artillery and its place as a key component of the combined arms team. Position warfare on a mass scale transformed artillery gunnery and enhanced its firepower. The adoption of indirect fire transformed gunnery from a problem of observation to a matter of mathematics. Throughout the war, the effect of firepower transitioned from short bombardments to massive week-long barrages back down to short, but intense, fires (see figures 2, 3, and 4). By the war's end, extensive planning, task organization, and realistic firing timetables made up for artillery weaknesses, most prominently, battlefield mobility and communications.

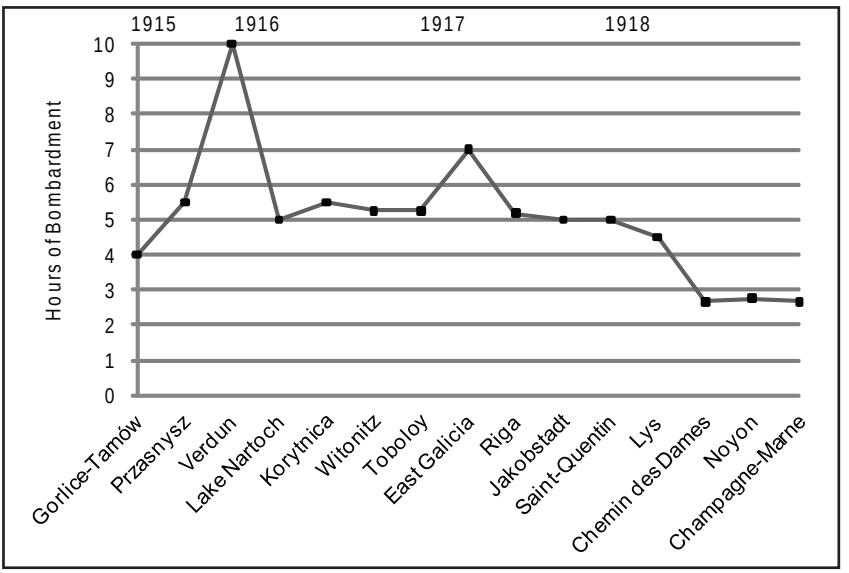


Figure 2. Length of artillery bombardments, 1915–1918: German.

In modern warfare, artillery became an area fire weapon. Its primary battlefield characteristic had become its ability to neutralize enemy units, enabling the other arms to maneuver against the enemy with minimal interference. The destructive effects of artillery firepower were distant secondary characteristics. By the end of the war, all combatants had realized this concept, although destruction by artillery fire would raise its head periodically in later wars.

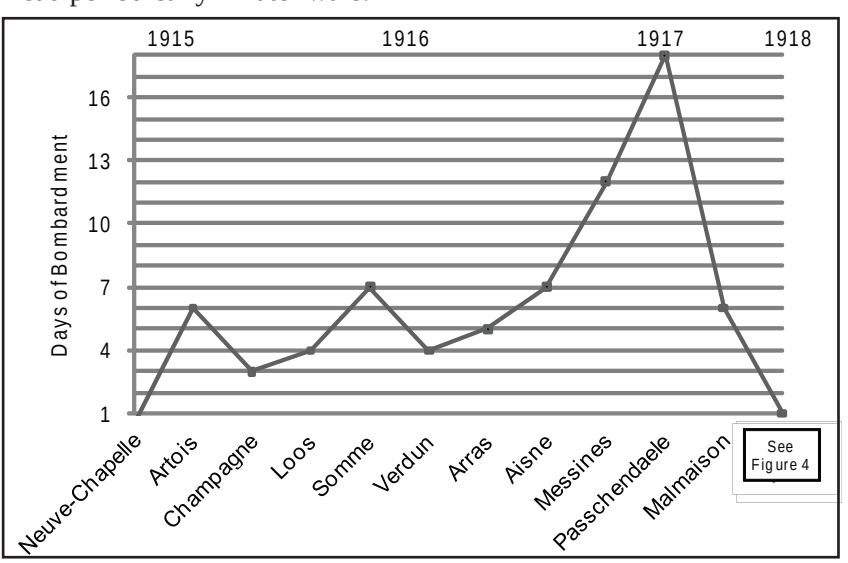


Figure 3. Length of artillery bombardments, 1915–1917: Allied.

Figure 4. Length of artillery bombardments, 1917–1918: Allied.

Close Air Support in World War I

The Wright brothers invented the airplane only a decade before World War I. In the interim period, aircraft improved to the point that both sides in the war fielded forces of planes designed for aerial observation.

Despite it being a technology only a decade old, most combatants had nevertheless created small aviation components before the start of World War I. The armies intended to use these aerial elements for reconnaissance. For example, at the start of the war, the Germans deployed four flying battalions. Organizationally, each aviation battalion was divided into three companies. But, for operational employment once war came, the companies were broken up into six-plane detachments, with each field army headquarters and infantry corps being given a detachment in direct support. During the war, aviation gradually expanded from providing air reconnaissance and limited artillery spotting to air-to-air combat (air superiority), and bombing of noncombat targets.[104]

By 1917, aviation technique and technology had advanced to where airplanes began contributing to the ground battle in a combat capacity. At first, both sides considered the role of close air support, similar to Hancock's view of artillery on 3 July 1863, to be more in terms of morale than actual

effectiveness, cheering on friendly troops by their presence and similarly disheartening the enemy beyond the limits of actual effectiveness. This thought changed when, by late 1917, massed air strikes began to inflict actual damage to enemy troops and equipment.[105]

The British had experimented with low-level troop strafing at the Battle of the Somme the previous year. When the Germans voluntarily retreated to the Hindenburg Line in February and March 1917, the British committed aircraft to strafing and bombing missions against the retreating Germans. Before this, the British Royal Flying Corps (RFC) usually stayed away from the front lines, attacking deeper into the German rear area or conducting air superiority missions against the German Air Service.[106]

From this time forward, the RFC and its successor service the Royal Air Force (RAF) gradually increased its role in close air support. Before the April 1917 Arras offensive, the RFC conducted a 10-day air attack on the German front lines, committing fighter planes to this mission for the first time. In July 1917, the RFC put bomb racks on fighters for the first time, allowing the smallest, most maneuverable aircraft to bomb enemy infantry positions.

The RFC's methods became increasingly sophisticated. In the attack, the British began sending their close support aircraft to immediately drop bombs and machinegun bullets on the German frontline trenches as soon as the preliminary artillery bombardment ceased, then shifting in front of the subsequent rolling artillery barrage to attack the German infantry before the artillery reached its positions.[107]

Despite these operational advances, the British still approached close air support in a relatively amateurish, haphazard manner. Rather than specific targets or sectors, RFC headquarters elements issued only vague "roving" orders to pilots and squadron leaders supporting the Passchendaele offensive in July and August 1917. Tactics centered on pairs of airplanes attacking small targets of opportunity.[108]

However, in November 1917 at Cambrai, the British command took great care in planning an experimental offensive using, for the first time, a large number of tanks. Aircraft were employed along with tanks and artillery in an integrated plan of attack. The RFC massed enough aircraft to initially outnumber the Germans 3 to 1 in the air. The Royal Flying Corps had committed 14 squadrons at Cambrai. Operating in flight strength rather than in pairs, these squadrons were given detailed sector and target assignments, with attention given to the German artillery. Weather and German antiaircraft defenses hindered the initial aerial contribution. The

RFC lost a third of its planes on the first 3 days of the Cambrai attack. The Germans countered by committing Baron Manfred von Richthofen's large fighter group. The RFC then mostly reverted to air-to-air operations.[109] When the Germans counterattacked at Cambrai, the battle became the first where both sides massed large air fleets. High in the sky, fighters dueled with each other while closer to earth both the British and Germans employed ground attack aircraft.[110]

The German approach was a little different. After a disastrous spring and summer of 1916 in which a defensive air posture lost them air superiority, the German High Command reorganized its Air Service, or *Luftstreitkräfte* (*LSK*), from the prewar structure of multifunctional aerial battalions into units with special functions. The principle of mass, originally applied to fighter operations in August 1916, was later applied to other types of operations. CAS units evolved from a series of six-airplane protection squadrons, or *Schutzstaffeln* or *Schusta,* that were established in January 1917 to protected air reconnaissance squadrons.[111]

Using the *Schusta*s, the Germans, too, began experimenting with close air support in 1917. During a counterattack in the Battle of Gravelle in April 1917, a *Schusta* plane for the first time strafed British positions in conjunction with an infantry counterattack. At Pilckem Ridge on 31 July 1917, during the Battle of Passchendaele, the Germans used bombers against attacking British infantry in the German's first deliberate CAS mission.

The role of *Schusta*s gradually changed from reconnaissance protection to close air support throughout 1917. By the end of 1917, the Germans began infrequent employment of massed CAS sorties.[112]

From the start, the fielding of an aircraft well suited for infantry support operations enhanced *Schusta* operations. As with the *Schusta*s themselves, the Halberstadt CL II, fielded starting in August 1917, was originally designed to provide fighter escort for air reconnaissance planes. This craft had the same performance characteristics as one-seater fighters but was less fragile and had a pilot and a machinegunner. By April 1918, more than 340 CL IIs were on the Western Front. The LSK was fielding an improved version, the Halberstadt CL IV, when the war ended. British observers commented on the difficulty of shooting down a Halberstadt with ground fire.[113]

The first *LSK* mass use of its Halberstadt CL II aircraft in a CAS role was during the German counterattack at Cambrai in November 1917. German air support was significant from the beginning of the battle. When

bad flying weather restricted high flying and air-to-air combat, the *LSK* added fighters to the ground battle. These were mostly used to fight off British close air support.[114]

Eight *Schusta*s with up to 48 planes participated in the German counterattack.[115] Flying at heights less than 100 feet, these planes supported the German infantry, which was using the new storm trooper infiltration tactics. The Germans quickly took back most of the terrain the British had taken in their tank attack. For both sides, Cambrai proved to be the first full-spectrum combined arms battle with both sides using novel field artillery and air support tactics and techniques. German success at close air support stunned the British to the point that the British command held an extensive court of inquiry in January 1918 to analyze the causes of German aerial success at Cambrai.[116]

US Air Force photo

Figure 5. Halberstadt CL II.

Before the RFC could digest the lessons of Cambrai, the Germans executed the first and largest of their spring offensives in March 1918, which featured the biggest assemblage of aircraft yet seen in the war. The Germans massed 730 airplanes for their first major offensive on the Western Front since Verdun in 1916. These aircraft were placed at the disposal of the ground commander to use at key places and times.

At the beginning of the offensive, the German *LSK* consisted of four types of aerial units: reconnaissance, fighter, bomber, and escort. The escort units (*Schusta*) were actually performing CAS operations at this point and,

accordingly, were redesignated as *Schlachtstaffeln* or attack squadrons (*Schlasta*) on 27 March 1918. For combat operations, the *Schlasta*s were, in turn, temporarily grouped into larger units, *Schlachtgruppen* (*Schagru*) or attack groups, of from 12 to 36 attack aircraft. In the March 1918 offensive, the *LSK* deployed 210 attack fighters in 35 *Schlasta*s under 11 *Schlagru*s.[117]

Before the offensive, the *LSK* drew up a detailed doctrinal manual for CAS operations based on the use of massed airplanes. These instructions included specific formations (line or column) for strafing trenches designed to comprehensively cover the attacked sector while, at the same time, spreading out the planes sufficiently to make them more difficult targets. This publication contained the first seeds of a longstanding dispute concerning the command and control and massing of CAS assets.[118]

In addition to new air doctrine, the Germans drew up a detailed plan to provide air support for their March offensive. While attack units normally provided *LSK* close air support, units made up of bombers were generally used for deeper missions and a bombing campaign against the English civilian population. However, for the March 1918 offensive, bombers were also designated to attack enemy ground troops. Previously, bombers had primarily operated at night. But technological advances in bomber design allowed the Germans to expand the bombers into limited daytime roles, attacking moving enemy targets such as reserves and tanks. Meanwhile, the fighter units, again including Richthofen's elite group, were designated to provide cover for the *Schlasta*s, the bombers, and reconnaissance aircraft.[119]

Canadian air historian Brereton Greenhous has presented the subsequent battle as one of paradoxes. While the Germans had refined the role of close air support, this specialization worked against them at Saint-Quentin as some of the CAS pilots were less adept when involved in air-to-air combat. While ground fog kept the *Schlasta*s grounded on the first day of the offensive, initially, the German fighter cover, long conditioned by Allied aggressiveness to wait for the enemy to come to them, remained high in the sky. Even so, the German infantry attack, using infiltration tactics and supported by a Bruchmüller barrage, was highly successful. The British reacted to this emergency by using all their fighters for infantry support to slow or stop the German advance. In this situation, Greenhous contends, the less-organized British were at an advantage by being able to improvise while the German fighters left them alone. The battlefield situation also favored the British CAS effort—the new German tactics and their success placed many German troops and supply and artillery

columns out in the open, increasing the effectiveness of aerial strafing and bombing. The RFC fired more than 21,000 rounds against ground targets on the first day of the offensive and double that intensity of fire on the second day. By the fifth day, this total had quadrupled to 92,000 rounds.[120]

By this time, the German fighters had shifted to attacks primarily against the British CAS airplanes. Nevertheless, despite great success by Richthofen's group, the British air command still managed to mass 100 aircraft against a sector threatened with breakthrough. On 26 March, the RFC fired a record 228,000 rounds at ground targets. The German attack soon gave out and Ludendorff himself commented directly on the effectiveness of British air-to-ground fire. The chief of staff of the attacking German army group estimated that air activity had caused roughly 50 percent of all German casualties. The British close air support evolved out of the need to respond to the crisis caused by the surprising German breakthrough.[121]

For the German part, the *Schlasta*s played a key role in the initial success of the offensive. With British aviation focused on close air support, the German attack aviation squadrons were equally free to attack ground targets without fear of air attack. The Germans began with a detailed attack plan, but the conditions of the battlefield soon caused them to violate the principle of mass, recently espoused in the new German air doctrine. In the German Air Service, there was a certain willingness to disperse CAS assets to provide support for all infantry units requesting it. Sometimes, groups as small as one or two airplanes supported a single infantry unit. Although the Germans professed the need for mass in close air support, they did not practice it in this their biggest air battle of the war.[122]

Schlasta losses in the Saint-Quentin battle were the equivalent of 4 complete squadrons (out of 35 committed to the operation) or 11 percent of the total force. The Germans continued to mass *Schlasta*s for the remaining five German offensives in April, May, June, and July 1918, but never at the same level as the first attack. By July, the Germans were on the defensive, a posture that continued until the end of the war in November. The British and Americans pressed the Germans with a series of offensives throughout this period.123

When the British attacked at Amiens in early August, the *LSK* was caught by surprise. Only a single CAS squadron was in the sector of the main effort. The *LSK* moved forces to the threatened region and fought well. However, the German Army was shattered in the battle. Meanwhile, a combination of the arrival of the Americans and the continued strain

on German logistical and personnel assets gradually saw the Allies gain complete numerical superiority in the air. *Schlasta*s began encountering shortages of aircraft and fuel as well as personnel.[124]

By the time the German Air Service faced large numbers of American troops in September 1918, the LSK was totally on the defensive and stretched thin. While German air doctrine almost exclusively was devoted to offensive use of close air support, once on the defensive, the air command did not give any further instructions. This forced local commanders to determine how best to use the *Schlasta*s in a defensive battle. At Saint-Mihiel in September 1918, there were initially no *Schlasta*s to support the defending German forces. Once a *Schlagru* with four subordinate *Schlasta*s was deployed to that front, its effect on the battle was minimal.[125]

The Germans fared better in the Meuse-Argonne battle. On this battlefront the LSK deployed 15 *Schlasta*s under 4 *Schlagru* headquarters. The attack of the US 35th Division, previously discussed in this chapter, was partially repulsed on 29 September 1918 (the fourth day of the offensive) because the Germans threw in a whole *Schlagru* at the Americans. It is interesting to note that, while the 35th's advance was considered a failure, on this day the Germans considered the division's advance to be the biggest threat to its defensive position. From the repulse of the 35th, the Germans drew the generalized conclusion that US troops could not hold ground against CAS strikes.[126]

As the battle progressed, the Germans reinforced their CAS assets with six additional squadrons. Losses were not as heavy as at Saint-Quentin, but were sizeable, with approximately 12 *Schlasta* airplanes shot down, most by air-to-air combat involving US Army Air Service fighters specifically tasked with shooting down CAS machines. The *LSK* demobilized its *Schlasta*s on 18 November 1918, within a week of the signing of the Armistice. Further development of CAS operations during the interwar period would have to be left to the air forces of other nations.[127]

For most of the war, the British and their Commonwealth allies used fighter planes in close air support, establishing the tradition of the flexible multifunctional fighter-bomber that has continued into the modern era. Nevertheless, the British eventually developed its own CAS craft, the Sopwith TF-2 Salamander, which was, in concept, the air equivalent to the tank. Styled a "trench-fighter," the craft first saw service in the new Royal Air Force in the spring of 1918, but only two squadrons were equipped with the craft when the war ended. The design emphasized trench strafing, with the fuselage made of armor plating and the armament consisting of

two .30 caliber machineguns and four small bombs. The British planned a massed production and fielding of the Salamander for 1919, but the Armistice ended these plans.[128]

Through feverish production, by the end of the war, the French deployed the largest air service of any of the combatants. While the Germans and British began fielding forces of airships and large, long-range bombers, the French concentrated specifically on tactical aircraft, fighters, and bombers that could be used at the front. While the fighters and bombers were sometimes used for CAS missions, it was not until May 1918 that the French organized a specific, autonomous ground support aviation unit, the *Division Aerienne* (*DA*) in May 1918.[129]

This force consisted of two brigades each organized with a fighter group (*escadre chasse*) and a day bomber group (*escadre bombardment jour*). Each group contained two or three subordinate squadrons (*group de combat* (*GC*) or fighter squadron and *group de bombardment* (*GB*) or bomber squadron). The remaining fighters in the French Air Service were assigned directly to army commands. The *DA* was a tactical bombing force designed to both lead the air activities of French offensives and provide an aviation reserve force. The complaints of ground commanders throughout 1918 threatened the force's independence.[130]

The concept of employment of the French *DA* was that the bombers provided close air support while the fighters provided cover. The fighters could also strafe ground troops if necessary. The division participated in the Franco-American counterstrokes in June and July 1918 and as a unit formed a large part of the aerial support for the Saint-Mihiel offensive.[131]

As with the artillery, the American Expeditionary Force developed its aviation branch virtually from scratch, depending on French and British equipment and experience. The American Air Service expanded from a size of 1,200 at the declaration of war in 1917 to a force of 82,000 at the time of the Armistice. American organization and doctrine generally followed that of France. While the Germans provided specialized "attack" aviation forces and specialized forces in general, the British and French used fighters and sometimes bombers for the close support mission. Accordingly, the US Army Air Service, too, did not form specific CAS units. Generally, fighter (pursuit) aircraft performed this mission as an adjunct to their main mission of air superiority, along with bomber units.[132]

The American aviation organization was directly tied to the ground organization. Air units were directly subordinated to ground commands.

The Chief of the Air Service position was actually an administrative post in the AEF headquarters. The two field armies eventually contained a group each of observation, day bomber and pursuit (fighter) planes. These groups typically contained one to four subordinate squadrons of the same type. The First Army, as the highest American field command for most of the St. Mihiel and Argonne operations, also fielded a pursuit wing under which were two additional pursuit groups. In addition, each corps in the field contained a group of observation planes.[133]

The American Air Service fought in two major campaigns, Saint-Mihiel and the Argonne. In both operations, Brigadier General Billy Mitchell was the senior air officer, first under First Army, then as the Argonne theater air chief. In the first of these campaigns, the air portion of the operation was highly successful. The attack surprised the Germans, who were initially outnumbered in the air 10 to 1. Mitchell maintained complete air superiority throughout the campaign as the Germans began a deliberate withdrawal from the Saint-Mihiel salient. US operations included CAS operations. The most important of these was the strafing of retreating German columns on 12 September 1918 near Vignuelles, which resulted in the capture of 15,000 prisoners of war the next day.[134]

The opinion of aerial success in the Argonne campaign was a matter of perspective. While Mitchell and other air observers saw the campaign as well executed, ground observers felt the Germans dominated the air and that US air assets were not employed in an aggressive manner. The major disconnect was one not of perspective but of priority. Mitchell, a noted advocate of airpower theory, prioritized the use of air assets differently from those of the ground commanders he supported.[135]

Billy Mitchell was a disciple of RAF Major General Hugh Trenchard, who commanded the British Independent Air Force in 1918, which was bombing German cities at night using large multiengine bombers. Trenchard believed in the strategic use of aircraft—bombing separately from ground operations to demoralize the enemy population or destroy essential war infrastructure. Trenchard had formerly commanded the RFC in a tactical role. As such, he also believed in the offensive role of fighter aircraft. To gain air superiority, fighters would fly forward into German territory and fling themselves at German fighter aircraft. It has already been seen where this policy had the effect on the Germans that their own fighters basically took a defensive posture, even when the ground forces were on the offensive as at Saint-Quentin. Trenchard also favored the mass use of aircraft even if it left certain parts of the front undercovered.[136]

Mitchell adopted Trenchard's concepts as his own. After Pershing vetoed his idea for the creation of a strategic air force, he became the senior air officer for the AEF's campaigns. Rather than stressing the direct support of the ground advance, Mitchell wanted to attack the enemy air force directly, as he considered the air force to be an offensive arm. At various times, he massed whole pursuit groups of up to 100 fighters for strikes against enemy aviation. During this early period of the Argonne battle, Mitchell's fighters shot down 11 German fighters in one day. These tactics created local superiority at certain places, but it left other areas unprotected. Mitchell was less attentive to portions of his command tied to supporting the ground troops, such as air observation units.[137]

While Mitchell massed and threw his fighters forward, as at Saint-Quentin, the Germans provided a more uniform coverage for their defending troops in the Argonne. To the American ground commanders, this seemed as if the Germans were dominating the air. Without Mitchell's attention, observation squadrons attached to divisions to provide general air reconnaissance and artillery spotting seemed less aggressive to their supported infantry and artillery units. Part of this was because Mitchell had removed their fighter cover and the observers had to pay attention to their own self-defense.[138]

Even though there were still complaints from ground commanders up to the end of the war, it is not debatable, as with artillery operations, that CAS operations improved greatly during the course of the Argonne battle. On 9 October 1918 in an attack that Mitchell was particularly proud of, a force of 200 bombers and 100 fighters attacked German troop concentrations. On 18 October, Air Service bombers and observation planes destroyed a German troop position at Bayonville that resulted in more than 1,000 enemy casualties. Fighters began strafing troops as a secondary mission that soon became typical. After massed German CAS formations of up to 3 squadrons (18 aircraft) caused significant battlefield setbacks, Mitchell shifted 4 squadrons of fighters (or pursuit aviation) to oppose the *Schlasta*s. They did so by flying split patrols with half the squadron at an altitude of 1,200 to 1,800 feet, above the low-flying *Schlasta*s, with the other half at more than 10,000 feet where it could protect the anti-CAS patrols from German fighters.[139]

What would eventually be considered the traditional characteristics of close air support were there from the start. Strengths included no restriction as to range in the tactical sense. Close air support was able to appear suddenly on the battlefield and provide immediate effects on point

targets and was virtually invulnerable to artillery fire. Terrain did not affect the performance of aircraft. There was a certain flexibility in the direct-fire nature of attack aircraft. If there was no target, the pilot could shift immediately to a different target.

Weaknesses included a vulnerability to increasingly more sophisticated ground antiaircraft fire, limited time in a target area, and bad weather affecting operations. Some weaknesses were shared with the artillery. Coordination and communications were difficult in the best of times, particularly with supported ground commanders. Preplanned missions were easier to execute than immediate ones, but sometimes less effective and possibly deadly in the form of potential fratricide.

Several long-lasting themes in aerial support originated in World War I. Most prominent among these was the notion of specialization versus multifunctionality. While the British, French, and Americans used fighter (or pursuit) planes and sometimes bombers and even observation planes in the CAS role, the Germans developed a specific CAS airplane and specialized CAS units as an offshoot of a previous specialized force that protected observer aircraft. Although not an exponent of CAS units per se, the RAF, too, felt the need to develop a specialized CAS aircraft, although it was not fielded in large numbers at the end of the war. This was perhaps a recognition that the characteristics of aircraft mostly conducting close support missions may not be the same as the optimum characteristics for air superiority fighters.[140]

Another theme is the definition of close air support. In World War I, the distinction that the US Air Force would later make between close air support and interdiction missions was not established. Later, air doctrine would define close air support only as attacks on troops in contact with friendly forces and interdiction strikes against ground targets not within friendly artillery range. The later distinction would increase the complexity over the theme of who should control and direct air support, airmen or ground personnel.[141]

Such control was an issue only in the abstract in World War I. Pershing organized the AEF's Air Service to place it firmly under the control of ground commanders at the theater, army, corps, and division levels. However, through the force of his personality and his direct control of field army-level assets, airman Mitchell was able to control and direct the course of air operations in the two major American campaigns.

Another theme that was only an abstract concept in 1918 was the contrast prominent in later American airpower theory and operations

between independent or strategic air operations and tactical air operations. While the British had established an Independent Air Force element to bomb deep into Germany and the Germans had fielded large bombers (Gothas and Giants) designed to bomb long distant targets, the US Air Service followed the French example and only operated at the tactical level. As a portent of the future, Mitchell, even while leading the AEF's tactical air forces, firmly believed in the moral and destructive effects of a force of long-range bombers operating independently. In fact, he tailored tactical operations to act on the same principles if on a smaller scale.[142]

Associated with this theme was the lack of glamour in the CAS mission. Almost a century after the war, the fighter pilots, depicted in the popular memory as fighting a separate war for air superiority, are still considered the ideal of the World War I pilot. The Red Baron is acclaimed for the 80 planes he shot down, not for the times he strafed trenches. Reflecting the contemporary glamour of the fighter pilot, many *Schlasta* pilots requested and received transfer to fighter units. While a new collective admiration for bomber crews replaced the glamour of the fighter pilot, which faded in the interwar period, the CAS pilot, except in the German World War II Luftwaffe, has retained a relative lack of respect into the modern period.[143]

Conclusions

The dichotomy between close air support and field artillery as separate elements of the combined arms team first appeared in World War I. The war transformed field artillery into its early modern form and created aerial support for ground operations. Field artillery was formerly a direct-fire weapon where line of sight allowed the guns to hit point targets with great accuracy. Battlefield conditions forced artillery to convert to indirect fire, dependent on separate observers and maps for accuracy. This increased coordination and communications difficulties.

While various replacements for direct fire of artillery were adopted, the most effective and most prominent of these was close air support. However, unlike direct-fire artillery, aerial support operated in a different plane where ground commanders could not directly communicate with the supporting arm.

Artillery had traditionally been divided into various functional categories, mostly based on the mobility of the guns. A few expert gunners such as Bruchmüller who, based on battlefield experience, mastered the mix of these missions, turned them into an art form. Although a new arm, aviation soon developed a roster of different missions as well. While artillery cannons were typically assigned missions based on gun characteristics, the

air forces of the combatants generally developed aircraft that could do several different missions, depending on the situation. Only the Germans, on the losing side, developed specialized equipment and units to perform specific missions. For the Germans, close air support was not an adjunct mission for fighters or bombers, but the main mission for its attack units.

Despite this, in most cases, aviation remained an arm of the Army similar to the field artillery in the World War I era. In response to German airship and long-range bomber attacks on England, the British created the Royal Air Force as a separate service to better protect the homeland or to conduct reprisal attacks against Germany. Ironically, the Germans still felt their air service was primarily an adjunct to the army, as did the French and Americans. However, in the interwar period, the anomalous British example gradually assumed primacy among airpower theorists.

Notes

1. Janice E. McKenney, *The Organizational History of Field Artillery, 1775–2003* (Washington, DC: US Army Center of Military History, 2007), 11–12.

2. John J. McGrath, *The Brigade: A History* (Fort Leavenworth, KS: Combat Studies Institute Press, 2004), 4–5.

3. "The American Revolution: The Battle of Monmouth," *Battlefield Detectives*, 26 November 2004.

4. Mark R. Gilmore, "Artillery Employment at the Battle of Gettysburg" (MMAS thesis, US Army Command and General Staff College, 1989), 2.

5. Mark R. Gilmore, "Artillery Employment at the Battle of Gettysburg" (MMAS thesis, US Army Command and General Staff College, 1989), 6.

6. Earl J. Hess, *Pickett's Charge—The Last Attack at Gettysburg* (Chapel Hill: University of North Carolina Press, 2001), 22–24.

7. Hess, 75; Gilmore, 17; Bradley M. Gottfried, *The Artillery of Gettysburg* (Nashville, TN: Cumberland House, 2008), 12.

8. Vardell Edwards Nesmith Jr., "The Quiet Paradigm Change: The Evolution of the Field Artillery Doctrine of the United States Army, 1861–1905" (PhD diss., Duke University, 1977), 11–12, 36; Gilmore, 16–17, 50–51; Hess, 75.

9. Hess, 23, 26, 75–76; John M. Priest, *Into the Fight: Pickett's Charge at Gettysburg* (Shippensburg, PA: White Mane, 1998), 182, 186–187.

10. Ibid., 22, 25. The Third Corps artillery had more optimistic orders. Batteries were to advance to Cemetery Ridge, the Union position, on seizure of that position and support from there. See Hess, 31.

11. Ibid., 113; John M. Priest, "Lee's Gallant 6000? Pickett's Charge Reconsidered," *North and South* 1 (Issue 6, 1998): 52.

12. Hess, 25–26, 28–30.

13. Hess, 180.

14. Hess, 22–23, 25, 27–28.

15. Hess, 33–34, 113; Gilmore, 47.

16. Hess, 113–116; Gilmore, 47.

17. Observers from both sides gave time estimates of between 45 minutes and 5 hours. The most common estimate was 1 hour. See Priest, *Into the Fight*, 194–195.

18. Hess, 163–164. Hess estimated that Union infantry losses from the bombardment were about 6 percent in the zone of the attack. Ironically, the Union counterbombardment had a greater effect on the Confederate infantry that was massed in woods beyond the artillery. Union long rounds usually landed in the infantry assembly areas. See Hess, 164–165.

19. Gilmore, 49–50; Hess, 146–147, 149; Nesmith, 38.

20. Gilmore, 50; Hess, 147.

21. Both Osborne and Hunt and even Meade later took credit for this decision. Hess, 150; Gilmore 54, 57.

22. Hess, 151, 155, 161; Gilmore, 54.

23. Hess, 160–163.

24. Hess, 171, 185, 188, 190.

25. Priest, "Lee's Gallant 6000?," 48–49, 52; Hess, 164–165, 232–233.

26. Hess, 306.

27. Gottfried, 232.

28. Hess, 149; Gilmore, 59–60.

29. Hess, 181–182.

30. Hess, 161–162; Gottfried, 15.

31. Hess, 391.

32. Gottfried, 13–15, 259; Kurt A. Schroeder, "Development of Tactical Geography in the Nineteenth Century," in *Studies in Military Geography and Geology*, ed. Douglas R. Caldwell, Judy Ehlen, and Russell S. Harmon (New York: Springer, 2005), 47.

33. Major General J.B.A. Bailey, *Field Artillery and Firepower* (Annapolis, MD: Naval Institute Press, 2004), 206–207; Bruce I. Gudmundsson, *On Artillery* (Westport, CT: Praeger, 1993), 1–2.

34. Gudmundsson, 1–2, 4.

35. Steven Allen Stebbins, "Indirect Fire: The Challenge and Response in the US Army, 1907–1917" (MA thesis, University of North Carolina, 1993), 84.

36. Gudmundsson, 7.

37. John J. McGrath, *Scouts Out! The Development of Reconnaissance Units in Modern Armies* (Fort Leavenworth, KS: Combat Studies Institute Press, 2008), 28. The British and Germans averaged more than six tubes per thousand infantrymen. See Bailey, 241. The contemporary American ratio was 2.82 per thousand. See McKenney, 107.

38. Gudmundsson, 25, 37; Vincent Meyer, "Evolution of Field Artillery Tactics During and as a Result of the World War" (Individual Research Paper, US Army Command and Staff School, 1930), 3–4; Robert M. Ripperger, "The Development of the French Artillery for the Offensive, 1890–1914," *The Journal of Military History* 59 (October 1995): 617; Bailey, 236–237.

39. Bailey, 236–238; Meyer, 3; Ripperger, 608; Leonard V. Smith, *Between Mutiny and Obedience: The Case of the French Fifth Infantry Division during World War I* (Princeton, NJ: Princeton University Press, 1994), 43n16; Ripperger, 604.

40. Smith, 43, 49.

41. Gudmundsson, 29; A. Seeger, "Our Baptism of Fire," *Field Artillery Journal* 5 (October–December 1915): 662.

42. Smith, 59. The French 75-mm gained such acclaim from its performance at the Marne that, after the war, a German general felt it was necessary to defend the quality of the German artillery. See Major General (Retired) Isbert, "The German and French Field Artillery at the Beginning of the War," *Field Artillery Journal* 8 (September–October 1920): 527–538.

43. Bailey, 243n9; Ripperger, 604.

44. At Le Cateau, the British field artillery lost 38 out of 43 guns. See David Lomas, *Mons 1914: The BEF's Tactical Triumph* (London: Osprey, 1997), 80–81. At Bertrix in the Ardennes, the artillery of the opposing sides actually engaged

each other with direct fire at close range. Infantry overran artillery positions on both sides, although ultimately, with the Germans holding the field, only the French lost their guns. See Terence Zuber, *Ardennes 1914: The Battle of the Frontiers* (Charleston, SC: The History Press, 2007), 147–150; Bailey, 243n9; Ripperger, 604.

45. Nesmith, 317, 322; Bailey, 237.

46. John J. McGrath, *Crossing the Line of Departure: Battle Command on the Move: A Historical Perspective* (Fort Leavenworth, KS: Combat Studies Institute Press, 2006), 78, 80; Ripperger, 604.

47. Bailey, 243; Smith, 81.

48. Bradley J. Meyer, "Operational Art and the German Command System in World War I," (PhD diss., Ohio State University, 1988), 266.

49. Bailey, 245; Lomas, 58, 73; Gudmundsson, 43; Smith, 111. At Guise on 29 August 1914, the French 5th Infantry Division learned this lesson directly. The division's first attacks without artillery support failed, but when the division artillery provided a proper preassault bombardment for the first time in the war, the infantry successfully ejected the German defenders from the fortified farmstead. See Smith, 53–54.

50. Bailey, 245–246.

51. Meyer, "Operational Art and the German Command System," 273; Gudmundsson, 50–51.

52. Gudmundsson, 51–53; Bailey, 245, 255.

53. Bailey, 249–250.

54. Meyer, "Operational Art and the German Command System," 278–279.

55. Bailey, 254, 256; Timothy Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War*, Leavenworth Paper No. 4 (Fort Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, 1981), 7–8.

56. Lupfer, 12; Bailey, 262.

57. Lupfer, 12–13; Bailey, 253.

58. Gudmundsson, 95–102.

59. Bailey, 250, 253–255.

60. Bailey, 253–254, 256.

61. Bailey, 255n44.

62. Gudmundsson, 44, 47–48.

63. Gudmundsson, 47.

64. Gudmundsson, 46, 50.

65. Gudmundsson, 47.

66. Bailey, 262.

67. Gudmundsson, 54–55.

68. Gudmundsson, 57.

69. Gudmundsson, 58–59.

70. Gudmundsson, 60–61; Bailey, 252; William Martin, *Verdun 1916: 'They Shall Not Pass'* (London: Osprey, 2000), 32–33.

71. Gudmundsson, 62.

72. Gudmundsson, 70; Bailey, 260.

73. Gudmundsson, 70; Lupfer, 19.

74. Gudmundsson, 89; Bailey, 258.

75. Lupfer, 17; Gudmundsson, 90; David T. Zabecki, *Steel Wind: Colonel Georg Bruchmüller and the Birth of Modern Artillery* (Westport, CT: Praeger, 1994), 37–38, 166–169.

76. Zabecki, 166–169.

77. Bailey, 259; Gudmundsson, 89–91.

78. Gudmundsson, 91.

79. Gudmundsson, 90–91.

80. Gudmundsson, 91; Zabecki, 43.

81. Gudmundsson, 90–91.

82. Gudmundsson, 91–93; Zabecki, 52.

83. Gudmundsson, 93.

84. Gudmundsson.

85. Gudmundsson, 95.

86. Gudmundsson, 98–100.

87. Gudmundsson, 100–101; Zabecki, 149, 153–154.

88. Zabecki, 64, 115–116.

89. Zabecki, 116; McKenney, 121.

90. Zabecki, 117.

91. John B. Wilson, *Maneuver and Firepower: The Evolution of Divisions and Separate Brigades* (Washington, DC: US Army Center of Military History, 1998), 48, 50; McKenney, 112, 115, 117.

92. *American Expeditionary Forces: Divisions*, vol. 2 of *Order of Battle of the United States Land Forces in the World War* (1931; repr., Washington, DC: US Army Center of Military History, 1988), 177, 179, 181.

93. Allan R. Millett, "Cantigny, 28–31 May 1918," in *America's First Battles 1776–1965*, ed. Charles E. Heller and William A. Stofft (Lawrence: University Press of Kansas), 161–162; McKenney, 121.

94. Millett, 161.

95. Millett, 169–170.

96. Zabecki, 117–118; McKenney, 120.

97. "7,000 Men Sacrificed, Gov. Allen Asserts," *New York Times*, 14 January 1919, 6; "No Artillery; Yank Division Cut to Pieces: Allen Says Shortage of Horses Crippled the Kansas Men," *Chicago Daily Tribune*, 14 January 1919, 3; Robert H. Ferrell, "Angered to the Core: Henry J. Allen and the US Army," *Kansas History* 29 (Autumn 2006): 186; *American Expeditionary Forces: Divisions*, 211, 219.

98. Robert H. Ferrell, *America's Deadliest Battle: Meuse-Argonne, 1918* (Lawrence: University Press of Kansas, 2007), 131; Robert H. Ferrell, *Collapse at the Meuse-Argonne: The Failure of the Missouri-Kansas Division* (Columbia: University of Missouri Press, 2004), 28–29, 3899. Ferrell, *America's Deadliest Battle*, 67, 131; Ferrell, *Collapse at the Meuse-Argonne*, 28–29, 43.

100. Ferrell, *Collapse at the Meuse-Argonne*, 59–63.

101. Ferrell, *Collapse at the Meuse-Argonne*, 65.

102. Ferrell, *Collapse at the Meuse-Argonne*, 85; Ferrell, *America's Deadliest Battle*, 130–134, 138.

103. Zabecki, 118.

104. Dennis E. Showalter, *Tannenberg: Clash of Empires, 1914* (Washington, DC: Brassey's, 2004), 152.

105. Brereton Greenhous, "Evolution of a Close Ground-Support Role for Aircraft in World War I," *Military Affairs* 39 (February 1975), 23.

106. Brereton Greenhous, 22.

107. Brereton Greenhous, 23.

108. Brereton Greenhous, 24.

109. The Red Baron, Rittmeister Manfred Freiherr von Richthofen shot down his 62d aircraft on 23 November 1917 during the German defensive phase of Cambrai. Richthofen shot down an RFC Airco De Havilland 5 (DH-5) biplane. The pilot, though badly wounded, survived. The DH-5 had originally been designed as an air-to-air fighter but, by November 1917, due to design flaws, was mostly used to strafe German infantry. The DH-5, piloted by Lieutenant James Boddy, was part of a flight strafing of the German trenches when Richthofen shot him down at an altitude of less than 100 meters. See Norman Franks, Hal Giblin, and Nigel McCrery, *Under the Guns of the Red Baron: The Complete Record of Von Richthofen's Victories and Victims Fully Illustrated* (London: Grub Street, 1998), 160–162.

110. Norman Franks, Hal Giblin, and Nigel McCrery, *Under the Guns of the Red Baron: The Complete Record of Von Richthofen's Victories and Victims Fully Illustrated* (London: Grub Street, 1998), 23–26; Bailey, 255n46, 257, 264.

111. Rick Duiven and Dan-San Abbott, *Schlachtflieger! Germany and the Origins of Air Ground Support, 1916–1918* (Atglen, PA: Schiffer, 2006), 14–15.

112. Rick Duiven and Dan-San Abbott, *Schlachtflieger! Germany and the Origins of Air Ground Support, 1916–1918* (Atglen, PA: Schiffer, 2006), 23–24, 26–27, 369; Bailey, 255n46, 257, 264; Greenhous, 23–24.

113. Greenhous, 26; Duiven and Abbott, 38, 139–141, 153.

114. Greenhous, 26.

115. Richtofen's fighter group remained in the Cambrai area for the counterattack, providing air cover to the *Schusta*s. On the first day of the counterattack, 30 November 1917, Richthofen shot down his 63d enemy aircraft. The RFC squadron attacked by Richtofen's fighters was patrolling over the front line on an air superiority mission. See Franks, Giblin, and McCrery, 163–164.

116. Greenhous, 26; Duiven and Abbott, 38.

117. Bailey, 255n46, 257, 260, 264; Greenhous, 23–24; Duiven and Abbott, 26–27, 52, 369. *Schacht* in German literally means "battle," but the equivalent American usage would be the word "attack."

118. Duiven and Abbott, 26–27, 43–45; John R. Cuneo, "Preparation of German Attack Aviation for the Offensive of March 1918," *Military Affairs* 7 (Summer 1943): 74–75.

119. Cuneo, 73–74.

120. Greenhous, 26–27.

121. Greenhous, 26–27. Richthofen's fighter group shifted from high-altitude air-to-air patrols to attacking British CAS aircraft by the fourth day of the offensive. From 21 March to 5 April, the baron himself shot down 9 enemy planes (numbers 67 to 75 in his tally) and killed 12 British airmen in support of the German offensive. Of these nine victims, seven were conducting strafing or bombing CAS missions. The latter two were in air superiority roles. See Franks, Giblin, and McCrery, 173–192. Richthofen was shot down and killed by ground fire in the same general area on 21 April.

122. Greenhous, 27; Cuneo, 78–79.

123. Duiven and Abbott, 52–53. The second largest assembly of attack aircraft was for the operation near Compiègne that started on 9 June 1918, where the German air command massed 26 *Schlasta*s. See Duiven and Abbott, 72.

124. Duiven and Abbott, 91–92, 96; Greenhous, 26.

125. Duiven and Abbott, 98–99.

126. Duiven and Abbott, 101–102.

127. Duiven and Abbott, 103.

128. The Army's Royal Flying Corps (RFC) merged with the Royal Navy's Royal Naval Air Service (RNAS) to form the independent Royal Air Force (RAF) on 1 April 1918. For the Sopwith Salamander, see *Jane's Fighting Aircraft of World War I* (New York: Military Press, 1990), 87; Greenhous, 26.

129. John H. Morrow Jr., "Defeat of the German and Austro-Hungarian Air Forces in the Great War, 1909–1918," in *Why Air Forces Fail: The Anatomy of Defeat*, ed. Robin Higham and Stephen J. Harris (Lexington: The University Press of Kentucky, 2006), 125; John H. Morrow Jr., *The Great War in the Air*: *Military Aviation From 1909 to 1921* (Washington, DC: Smithsonian Institution Press, 1993), 282–283; Bailey, 260n65; René Martel, *French Strategic and Tactical Bombardment Forces of World War I*, tr. Allen Suddaby (Lanham, MD: Rowman & Littlefield, 2007), 252.

130. Morrow, *The Great War in the Air*, 283–284; Eric Lawson and Jane Lawson, *The First Air Campaign: August 1914–November 1918* (Conshocken, PA: Combined Books, 1996), 237.

131. Ibid.; *American Expeditionary Forces: General Headquarters, Armies, Army Corps, Services of Supply, Separate Forces*, vol. 1 of *Order of Battle of the United States Land Forces in the World War* (1937; repr., (Washington, DC: US Army Center of Military History, 1988), 97.

132. Ferrell, *America's Deadliest Battle*, 123; Daniel R. Mortenson, "The Air Service in the Great War" in *Winged Shield, Winged Sword: A History of the United States Air Force*, vol., 1, *1907–1950*, ed. Bernard Nulty (Washington, DC: US Air Force History and Museums Program, 1997), 51, 69.

133. Lawson and Lawson, 236–237.

134. Mortenson, 66; John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946–1973* (Washington, DC: US Air Force History and Museums Program, 2003), 15.

135. Mortensen, 69.

136. Mortensen, 39; *A Short History of Close Air Support Issues* (Fort Belvoir, VA: Institute of Special Studies, US Army Combat Developments Command, July 1968), 2–3.

137. Mortensen, 59–60, 67–68; Ferrell, *America's Deadliest Battle*, 124–125.

138. Mortensen, 65; Ferrell, *America's Deadliest Battle*, 122–124.

139. Duiven and Abbott, 103; Ferrell, *America's Deadliest Battle*, 125; Mortensen, 68.

140. Schlight, 7.

141. Schlight, 18.

142. Ironically, the Germans believed that their *Schlasta* units provided a great moral boost to the infantry with their low-level attacks on the enemy trenches. See Duiven and Abbott, 6.

143. Duiven and Abbott, 42, 378–381.

Chapter 2

World War II: Field Artillery and Close Air Support in High-Intensity Combat

The interwar period was crucial to the development of modern field artillery and airpower theory, technique, and tactics. Theory shifted into practice in World War II where airpower came to age and modern field artillery became refined to provide effective support in both static and mobile operations. In both of these fields, the United States Army led the way in both theoretical and technical developments in the interwar period and in execution during World War II.

The United States Army became the leader in developing field artillery tactics and techniques during the interwar period. The US Army Field Artillery School created and refined the concept of the fire direction center (FDC), which removed many of the problems associated with the use of observers in World War I and broke artillery fire away from the restraints of rigid timetables and the supremacy of preplanned fires.

Close air support, while prominent in the early part of the interwar period, soon lost ground as Britain and the United States developed independent air forces based on the theory of strategic airpower. Therefore, when World War II produced the need to provide close air support for large armies, the British and Americans had to develop CAS procedures based primarily from wartime experience rather than from peacetime planning. Although developed on the fly, Allied close air support, using multifunctional aircraft, proved to be highly effective, both on the battlefield and (as interdiction) in hindering German tactical- and operational-level movements.

When the Germans created the Luftwaffe in the mid-1930s, its doctrinal emphasis was descended primarily from that of the wartime *Schlachtstaffeln*. This emphasis served the Germans well in the early offensive campaigns of World War II where specially designed dive-bombers proved to be effective in a "flying artillery" role. However, a large part of this force later became diverted to strategic bombing and homeland defense. As in World War I, the Germans were eventually overwhelmed by enemies with much larger air forces.

Field Artillery in the Interwar Period

In the interwar period, the US Army Field Artillery School developed techniques to improve field artillery gunnery and battlefield responsiveness.

Due to old school parochialism, many of these changes were not formally adopted until wartime forced the issue in 1941–1942. These changes caused a marked improvement in artillery fire during the war, particularly in terms of massing fires and coordinating infantry and artillery. The effect was so marked that many nonartillery military observers, including General George Patton, considered field artillery a decisive factor in the Army's successful operations in the war.[1]

Interwar field artillery developments included revised doctrine, gunnery, and observation procedures. Despite the AEF's success in fielding and using massed artillery, artillerymen saw a need for change. In the early postwar era, few of them thought the guns had maximized their available firepower in World War I. Few infantrymen believed that the artillery had adequately supported the offensive. Artillery innovation in the interwar period was, accordingly, based on the need to maximize firepower and responsiveness.

In terms of doctrine, the main debate throughout the period was the conflict between notions of trench warfare tactics versus open war tactics. Pershing had been the main proponent for open warfare tactics. In the Field Artillery branch, many senior officers who had not deployed overseas sided with Pershing. In terms of the guns, open warfare adherents considered the principal characteristics of trench warfare methods to be the use of map spotting for targeting and the implementation of barrages in front of advancing infantry. The debate continued throughout the interwar period and written doctrine represented a compromise between both positions. As late as September 1939, one American artillery observer commented that German operations in Poland showed a reversion to open warfare methods. Offensive artillery fire would depend on a variation of the Bruchmüller method of a succession of massed artillery fires preceding the infantry advance. The contrast between open and trench warfare methods became irrelevant with the advent of the new gunnery and observation methods.[2]

During the interwar period, the gunnery department at the Field Artillery School developed improved techniques that greatly increased the responsiveness of fires. During his 4-year tenure (1929–1932) as the head of the Gunnery Department, Major Carlos Brewer revolutionized fire direction through several innovations. Brewer developed the observed fire chart and the fire direction center. The FDC centralized artillery fire at the battalion and higher levels, allowing improved massing of fires. Brewer also implemented a new, highly effective technique for adjusting artillery fire from an aircraft (air-ground observation method). At the same time, the Army fielded a new portable radio, the SCR-161, which provided

effective communications between the observer and the FDC. This radio allowed the observer to be more mobile since there was no wire. Brewer's successors refined the gunnery techniques, developing precalculated firing tables and improved firing charts.[3]

The development of the FDC remained an academic exercise through the 1930s. The FDC concept was not totally adopted on an organizational basis until April 1942 when the artillery battalion table of organization included an FDC under the battalion operations section (S3). FDC refinements also affected the concepts of forward observation and accompanying guns.[4]

The interwar Infantry branch did not believe the field artillery had been responsive enough in World War I. The foot soldiers felt there was no adequate solution to the requirement for immediate fires. The infantry solution was the twin concepts of infantry guns (a battery firing from right behind the front line) and the accompanying gun (a single gun in the front line firing at point targets). Artillery after-action reports viewed these concepts as being ineffective during the war, primarily because the artillery piece was not suitable for this role. By 1924, the Army recognized the use of the infantry gun to only be a last option. Nevertheless, each infantry regiment received a howitzer company in the interwar period with one cannon platoon attached to each infantry battalion. After an organizational overhaul in 1941, a cannon company became part of the infantry regimental organization throughout the war.[5]

In the early interwar period, the Field Artillery branch still favored the prearranged fire plan. But the development of the SCR-161 radio in the early 1930s allowed the artillery liaison officer teams assigned to infantry regimental and battalion headquarters since the war to deliver fire against targets of opportunity within 10 minutes. The creation of the FDC enhanced this role as the ALNO could now send fire requests directly to battalion FDCs, cutting response time down to several minutes. The fielding of a new radio, the SCR-194, with a range of 4 miles further enhanced this responsiveness.[6]

There is a natural resistance to change, and despite these enhancements, the ALNOs, who had become de facto forward observers (FOs), remained only as far down as infantry battalion headquarters up until late 1942. However, after initial operations in North Africa, the Field Artillery began placing FOs in every infantry company. This system, placing a trained artilleryman in the front lines with the infantry, proved to be highly successful during World War II. The Army retained this system until the late 1970s.[7]

http://www.gordon.army.mil/OCOS/Museum/AMC/images/SCR194.JPG

Figure 6. SCR-194 radio.

Artillery mobility was also an interwar concern. During the war, the AEF had used horses to haul artillery pieces and ammunition. Even then, the Army preferred to use mechanized tractors or trucks to pull the pieces. In the 1920s, the artillery developed three types of mobility techniques for the artillery: trucks and tracked vehicles to tow pieces and guns mounted on tracked vehicles (self-propelled). Budgetary concerns slowed this process. However, motorization increased in the 1930s. By 1939, 68 percent of the batteries in the Regular Army were motorized, using a mix of cargo trucks and mechanized tractors. As with other interwar innovations, complete innovation had to wait until mobilization in 1941.[8]

The interwar period was one of innovation and modernization for the American field artillery. But full implementation of these developments

awaited full mobilization in 1940–1943. When US artillery performed well in its first battles in Tunisia in 1942, it was the fruitful result of concepts and ideas conceived in the interwar period.

Close Air Support in the Interwar Period

The US Air Service ended World War I on a high note. From the aerial and AEF headquarters perspective, operations in the Argonne and Saint-Mihiel were considered a grand success. The opinion of offensive CAS operations was at their highest point among the American air community. One of the senior AEF air officers, Brigadier General Benjamin Foulois, even proposed creating American specialized attack units in the postwar Air Service. In December 1918, Billy Mitchell wrote a doctrinal manual that rivaled that of the Germans in detail as to the conduct of CAS operations. By 1920, however, Mitchell had moved beyond tactical aviation and was soon pressing for creating a strategic force equipped with long-range bombers.[9]

Mitchell was the exception in the early interwar era. In this period, the Air Service (and after 1926 the Air Corps) focused on ground support operations. The service created specialized CAS organizations, referred to as attack units, and flirted with creating functional ground support aircraft. In 1921, the Army created the first four attack squadrons and first attack group. Each squadron contained 18 aircraft. The fielding of such a unique organization waxed and waned following the vicissitudes of the interwar peacetime budget. Attack units reached a height of seven squadrons, two groups, and a wing in 1939. However, since 1935, such units received low relative priority not based on the budget but on organizational priority, which had shifted in favor of strategic bombing. On the eve of World War II, attack squadrons represented only 12 percent of the Air Corps force structure. In contrast, fighters and bombers each represented over a quarter of the organization.[10]

The primary mission of the attack units was close air support, with a secondary mission of deep strikes against point targets. In the late 1930s, Air Corps thought was rapidly shifting in a manner that marginalized close air support. For attack units, this meant a gradual shift away from ground support to providing the equivalent of close air support to the bomber fleet. The attack units would destroy enemy airfields and antiaircraft defenses. Support for ground operations became the last priority. In 1940, the attack units were redesignated as light and medium bombardment squadrons and groups.[11]

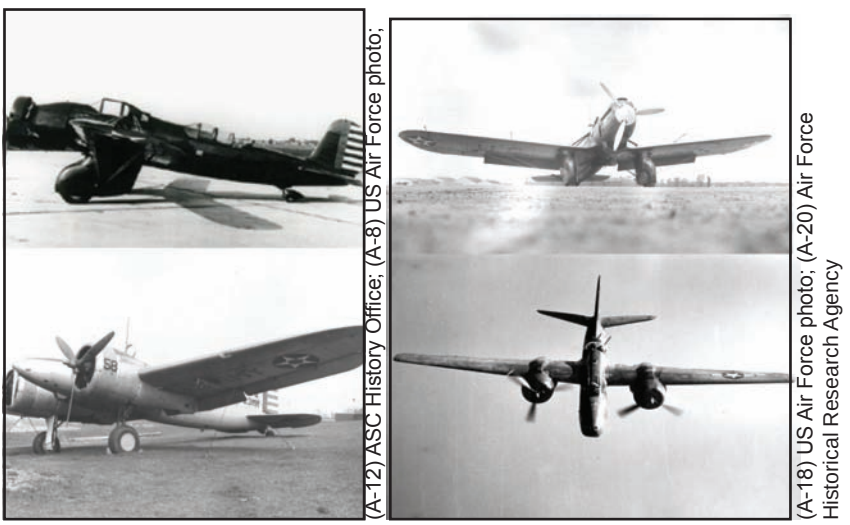
In the war, the Air Service had been subjugated to the ground chain of command. This continued in the peacetime service. However, the Air Service soon began pushing for the control of all air assets except observation squadrons, including attack squadrons, in an air chain of command. Such air support would remain centralized and be parceled out on a mission basis. The Air Corps Act of 2 July 1926 settled this issue for the most part in favor of the Air Service. The new Air Corps received centralized control of all air assets except observation squadrons. The Air Corps retained the policy of keeping attack aviation assets in a centralized pool rather than assigning them to ground control up to the eve of World War II.[12]

In 1935, the Air Corps received even more autonomy with the creation of the General Headquarters (GHQ), Air Force. From this time forward, Air Corps priority was strategic bombing. The new attitude was clearly evident in an Air Corps tactical school (ACTS) memo of December 1936 that expressed the idea that the Air Corps should not "dissipate" its effort on close air support until it had first created an "adequate" strategic bombing force. Supporters of strategic airpower believed that it would relegate the CAS mission to one only required "in peacetime maneuvers."[13]

The Air Corps developed its first planes specially designed for close air support during the interwar period. As with most interwar aviation developments, specialized attack aircraft were soon swept away in the fervor for strategic bombardment. Throughout the 1920s, technological limitations and the Air Corps desire to economize its inventory by using multifunctional aircraft stymied attempts to develop specialized CAS aircraft. Accordingly, in the 1920s, the Air Service employed surplus war vintage DH-4 day bombers and several observation planes (the Douglas O-2 and the Curtiss O-1) for CAS purposes. The Curtiss O-1 was upgunned and redesignated as the A-3, the first specifically designated attack airplane in the American inventory.[14]

In the 1930s, the Air Corps developed a series of attack craft from scratch, including the Curtiss A-8, followed by the Curtiss A-12 Shrike and the Northrup A-17. The characteristics of each plane included a single engine, fast airspeed, and an armament of between four and six machineguns and four bomb racks. The A-17 had a range of 1,160 miles. The shift in priority to support for the strategic bombing program affected the attack aircraft program. In 1938, the Curtiss A-18 began replacing the A-17. The twin-engine A-18 saw a move away from bullets to bombs in CAS aircraft. This was considered to be an important lesson of the Spanish Civil War. But more important, because of the A-18's bombing capability,

it could suppress enemy defenses in support of strategic bombers. In 1939, the Air Corps began deploying the Douglas A-20, a light bomber that could do other missions aside from close air support. The Air Corps rejected the development of dive-bombers because of their unifunctional nature as CAS aircraft.[15]



(A-12) ASC History Office; (A-8) US Air Force photo; (A-18) US Air Force photo; (A-20) Air Force Historical Research Agency

Figure 7. Attack aircraft: A-12 (top left), A-8 (top right), A-18 (bottom left), A-20 (bottom right).

Communications and coordination with ground forces were major problems with close air support in World War I. The former was a technological problem, the latter an organizational and training one. Well into the 1930s, communications technology remained at the 1918 level. Finally, the fielding of reliable two-way radios began in the mid-1930s.[16]

Air-ground coordination received limited attention in the interwar period. There were few joint air-ground exercises. Both elements used only notional forces to portray the other element. In 1936, Major General Frank Andrews, the first commander of the GHQ, Air Force, and a leading bomber proponent, even rejected the very concept of air-ground teamwork. Andrews considered that Air Corps independence required no input from the ground for planning and executing missions, including ground support ones.[17]

On the eve of World War II, US close air support, despite technological developments, was in a worse state than it was in 1918. Using the glamour and prestige of the airplane, the Air Corps successfully pushed forward

its program for an air force stressing the strategic bomber at the expense of support to the ground forces. While strategic bombing was to continue to be the main effort of the Air Corps during World War II, wartime requirements were to revive close air support.

Outside the United States, there were similar and differing trends. In Britain, strategic bombardment was also the priority. During the interwar years, the first independent air service, the British Royal Air Force gradually came to stress strategic bombers over all other facets of airpower. One interpretation of this development is that the British nation, traditionally a seapower that applied strategically a maritime blockade to defeat its foes, naturally applied airpower in a similar fashion as an offensive version of the blockade. As seapower was applied to place a gradual, passive economic stranglehold onto an enemy state, airpower could place an active economic stranglehold by destroying enemy infrastructure, economy, and morale. While this mind-set may have been in the background of RAF development, there were two concepts that more directly influenced the RAF in the interwar years.[18]

The first of these was the use of the RAF to police Iraq in the 1920s when the British held a League of Nations mandate over the newly created country. As an economy-of-force measure, the British policed Iraq, a vast territory with a relatively small population, with the RAF rather than ground troops. The concept was that aircraft would be centrally based and dispatched to trouble areas on a situational basis. Supporting this tactic, the RAF established a series of small posts with British liaison officers around the country. Supporting the RAF were several Arab auxiliary forces, some as air base guards, others in the desert usually equipped with small fleets of armored cars mounting machineguns. A proper Iraqi Army, which was established in 1921, augmented the RAF. The RAF conducted operations in Iraq from 1921 to 1930. In 1924, a series of air patrols operated against raiding *Ikhwan*, zealous religious warriors from Saudi Arabia, which culminated in small-scale bombing attacks in December 1924. They remained a threat until 1930 when the Saudi king crushed them.[19]

The campaign in Iraq, under RAF auspices, was basically an air force operating with minimal ground forces. The attacks on the *Ikhwan* were similar to the close air support in World War I, except no infantry was there for support. The forces on the ground were small groups of RAF armored cars or bedouins on camels. Such a campaign gave the impression that the RAF had controlled Iraq using airplanes and that aviation could operate independent of land or sea forces. In fact, this was an oversimplification,

and when Iraq threatened to transfer its allegiance to the Axis powers in World War II, the British had to send a ground force to conquer Iraq.

The second concept that groomed RAF development was the fear of terror bombing. In World War I, the Germans launched the first strategic bombing campaign that terrorized the English public. The RAF was formed in April 1918 as a result of the German bombing campaign. Only centralization of air assets was felt to be an effective defense against the terror bombing. Retaliation was considered a suitable recourse. Accordingly, the RAF also produced a force of long-range, multiengine bombers that attacked Cologne in August 1918. The RAF was born as an organization imbued with the theory of strategic bombing.[20]

When the Germans began rearmament in 1935, the creation of the Luftwaffe sparked British concern for future terror bombing. In 1936, the RAF reorganized into three functional components. The Fighter Command was designed to defend Britain against German bombers. The Coastal Command had the mission of defending the coasts of Britain by air. The Bomber Command was a strategic offensive force. As in the United States, close air support received minimal attention.

Ironically, while the RAF developed along lines to defend against terror bombing or apply its assets to conduct its own such campaign out of a fear of German capabilities, the Germans were not developing such capabilities. After having been banned from maintaining an air force by the Treaty of Versailles, the ascension of Hitler to power in 1933 resulted in a gradual rejection of the terms of the treaty. The new air service, the Luftwaffe, was revealed publicly in 1935 as an independent air force.

The World War I German Air Service had developed specialized units for close air support, fighters, and strategic bombers. But, while the Germans had conducted the first strategic bombing campaign in 1916 and 1917, the new Luftwaffe ultimately relegated strategic bombing to a distant secondary role to close air support. Early on, the Germans supported the creation of a strategic bomber force. However, the death in an air crash of the Luftwaffe's first chief of staff, Lieutenant General Walther Wever, in 1936 curtailed this track. Wever was a military theorist of the first order who developed a detailed doctrinal manual for the Luftwaffe. While stressing air support for Army operations at the tactical and operational levels, he also viewed a strategic bomber force as possibly decisive in future warfare. Wever envisioned a strategic campaign concurrent with operational and tactical air operations.[21]

After his death, the Luftwaffe leadership, finding itself in the middle of a massive and swift rearmament, inverted the priorities of the US Army Air Corps. As a landpower surrounded by several potentially hostile states with large armies, German airmen felt that creating an air force capable of fully supporting the land forces was the number one priority. Once such a force was established, the Luftwaffe could then look at establishing a strategic force. However, the war started before this could be done, and then during the war, the High Command gave the Luftwaffe strategic missions anyway.[22]

In the immediate prewar period, the Luftwaffe developed an excellent CAS dive-bomber, the Ju-87 Stuka, and an efficient system of air-ground coordination. Organizationally, the Luftwaffe set up a command headquarters that matched those of the army that commanded all the air units supporting that army echelon. These units included CAS dive-bombers as well as fighters, reconnaissance aircraft, and air transports. The air headquarters were collocated with the respective army headquarters. Air units were assigned to these headquarters based on the support required for the ground forces. At lower levels, there were Luftwaffe air signal liaison parties that provided liaison and ground attack teams assigned to regimental headquarters that directed airstrikes. Most air missions were preplanned jointly the previous day, but the German system provided enough flexibility to redirect or change missions on the fly. The air and ground elements trained together extensively.[23]

US Army Field Artillery in World War II[24]

US field artillery in World War II was an unmitigated success in all theaters from the beginning to the end of the war. The role of field artillery was so dominant that one infantry battalion commander in France in 1944 who later rose to general rank, William DePuy, remarked that he believed his most important duty as a battalion commander was to get his field artillery forward observers to the next hilltop from which they could direct fires onto the Germans. From the start, US artillery displayed a great ability to mass and shift fires on the battlefield.[25]

In 1940 and 1941, the Army reorganized its divisions from the World War I pattern to a new, streamlined one. To streamline the artillery organization into a less fixed and rigid structure, in 1942–1943, the Army Ground Forces broke up field artillery regiments and brigades. Group headquarters replaced most artillery brigade and regimental headquarters. Battalions became separate, self-contained (administratively) units. Corps and division artillery (DIVARTY) headquarters replaced brigades.[26]

(105-mm) DOD photo; (Priest) US Army photo

Figure 8. Towed 105-mm howitzer (left) and the 105-mm self-propelled Priest (right).

The basic direct support (DS) weapon was the 105-mm howitzer. In the infantry division were 3 DS field artillery battalions with 12 105-mm howitzers towed by trucks organized into 3 four-gun batteries. Each battalion was equipped with towed 105-mm howitzers and provided FO teams to the nine rifle companies within the regiment it supported as well as an ALNO team at the regimental headquarters. The armored division contained three DS armored field artillery battalions equipped with 105-mm howitzers mounted in an armored tracked vehicle. Each battalion typically supported one divisional combat command, roughly the equivalent to an infantry regiment. In the armored division, the DIVARTY battalions had enough FO parties to provide one party for each tank company, mounted in its own M4 Sherman tank. Operationally, the armored division usually task organized into battalion-size task forces. In these cases, each task force contained a single FO party. Each of the headquarters batteries in the four infantry division field artillery battalions and the DIVARTY headquarters contained two L-4 light planes. These aircraft provided an aerial observation capability for the units.[27]

Only in armored field artillery battalions were forward observers part of the formal organizational structure. Throughout the war, artillery commanders in infantry divisions organized FO parties on an ad hoc basis. Each firing battery and the battalion headquarters were tasked to provide a lieutenant and several enlisted men and a jeep to support one of the rifle companies.[28] Figure 9 shows the World War II field artillery fire support system.

Supporting the DS artillery were numerous battalions of medium (155-mm howitzers or 4.5-inch guns) or heavy artillery (240-mm howitzers, 8-inch guns and howitzers and 155-mm guns). Field artillery groups controlled these battalions. Corps artillery headquarters, in turn, controlled the groups. The infantry division also contained a general

support battalion of 12 155-mm towed howitzers. The nondivisional artillery had two missions. The medium pieces were designed to augment divisional artillery forces. The heavy artillery, usually pulled by armored tractors, was earmarked for long-range missions such as interdiction and counterbattery fire.[30]

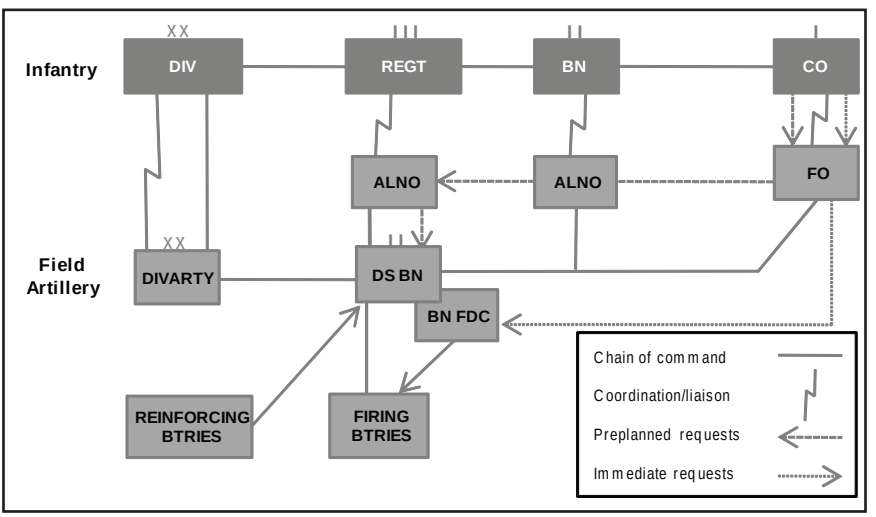


Figure 9. World War II Field Artillery Fire Support System.

At the battalion and regimental levels, the ALNO coordinated the field artillery support as a whole. Between them, the ALNOs and the FOs, with their express links to the DS field artillery battalion FDCs, controlled a large amount of responsive firepower. General DePuy's comment about the importance of his FOs was well taken.

Table 2. Phases of Tactical Air Operations per FM 100-20, 1943

Priority	Mission
1	Air superiority (destruction of the enemy air force)
2	Interdiction (the isolation of the battlefield)
3	Close air support

Warfare in the European and Mediterranean theaters was high-intensity combat that was mostly linear and sometimes fast moving. US artillery proved to be vital on both offense and defense. In the Pacific theater, artillery operations had to also routinely conduct amphibious operations and fight in jungles. Jungle warfare necessitated different gunnery and

observation techniques. Gunners often had to employ high-angle fire to penetrate the canopy of vegetation. Observation was generally limited, requiring specialized techniques both for target and observer location.[31]

US Army Air Force Close Air Support in World War II

As with the field artillery, tactical air operations in World War II were considered a success story and a strong arm of the American military effort. In the late interwar period, close air support had become an extremely low priority for the Air Corps (after June 1941, the Army Air Force (AAF)). However, German successes in 1939 and 1940, which highlighted the close relationship between ground forces and air support, revived interest in close air support. Additionally, in 1941, with mobilization in full swing, the War Department decided not to raise a proposed force of very heavy artillery and limit the number of heavy artillery pieces. The AAF was to use the resultant cost savings to develop CAS systems.[32]

Large exercises in 1940 and 1941 revealed the weakness in the current CAS system. Accordingly, the chiefs of the Army and AAF, General George Marshall and Lieutenant General Henry "Hap" Arnold, pushed for the production of a joint doctrine for close air support. The Army accordingly published FM 31-35, *Aviation in Support of Ground Forces*, in April 1942. The new doctrine revised definitions. Close air support now defined only direct action in support of ground forces. Interdiction applied to such actions beyond artillery range, and air superiority was now considered a separate, but primary, mission.[33]

The new doctrine was a compromise solution. While establishing centralized control over tactical air operations under an AAF officer, this officer, in turn, was also a staff officer to a field army or theater commander. The ground commander provided the mission and had final authority on prioritization. The air commander decided how best to accomplish the ground commander's authority.

After the Tunisian campaign, with the approval of Army Chief of Staff Marshall, the AAF issued a new manual, FM 100-20, *Command and Employment of Air Power* (July 1943). This manual provided for centralized control of air assets under the senior air commander and accorded close air support as the last priority of tactical air missions. FM 100-20 established three phases of priority (table 2). A combination of centralized control and the prioritized phases caused most air missions to be preplanned in the early part of the Italian campaign, and only 20 percent of all air missions were close air support. Higher air headquarters planned and executed the remaining 80 percent.[34]

Few ground commanders would dispute the necessity for air superiority as a prerequisite for close air support. Ground and air commanders often differed on subsequent priorities. Once Allied air gained air superiority, disputes over prioritization did not often arise as the personal relationships between the field army and air support commanders quickly became one of cooperation. Additionally, air superiority left large numbers of fighters available for CAS missions.[35]

FM 100-20 was not specific enough that commanders in the field could create an improvised air-ground system in Sicily and Italy. This included creating mobile air control parties (ACPs) equipped with jeep-mounted VHF radios capable of talking directly to fighter-bombers and collocating air and ground headquarters at the field army level.[36]

These innovations were transferred to the European Theater of Operations (ETO) for the 1944 invasion of France. In preparation for operations, the Ninth Air Force, the command responsible for theater tactical air operations, redesignated its fighter commands into tactical air commands (TACs). The TACs were the descendents of the early war Air Support Commands. Each TAC was informally assigned to support a specific field army in the campaign. The TAC headquarters located with the field army headquarters. This informal arrangement centralized air support at the field army level rather than at the theater level as prescribed in FM 100-20. The purpose of theater-level centralization was to control the air superiority effort. But, in the ETO, air superiority was assured from the start of the campaign as the Luftwaffe was weak in strength. Additionally, the Eighth Army and RAF Bomber Command were operating within the theater conducting the strategic air campaign against Germany.[37]

The TAC directly commanded the fighter, bomber, and reconnaissance wings, groups, and squadrons that executed the air missions. The coordination of air missions began at the TAC/field army level. Starting in the Italian campaign, AAF tactical air commands began forming small parties headed by pilots to act in a forward observer (air control parties) or aerial observer (forward air controllers (FACs)) role for CAS missions. ACPs rode in jeeps equipped with VHF radios and acted similar to FOs in companies. ACPs, however, generally coordinated their activities with division or infantry regimental headquarters. FACs operated either in cooperation with DIVARTY aerial observers or on their own. Both ACPs and FACs were equipped and authorized to direct immediate CAS strikes from loitering aircraft, which had been either diverted from other missions or had been kept in reserve specifically for such missions. Initially, such missions took up to 10 minutes to execute. But with experience and

refinements, immediate CAS missions could be executed much more quickly.[38]

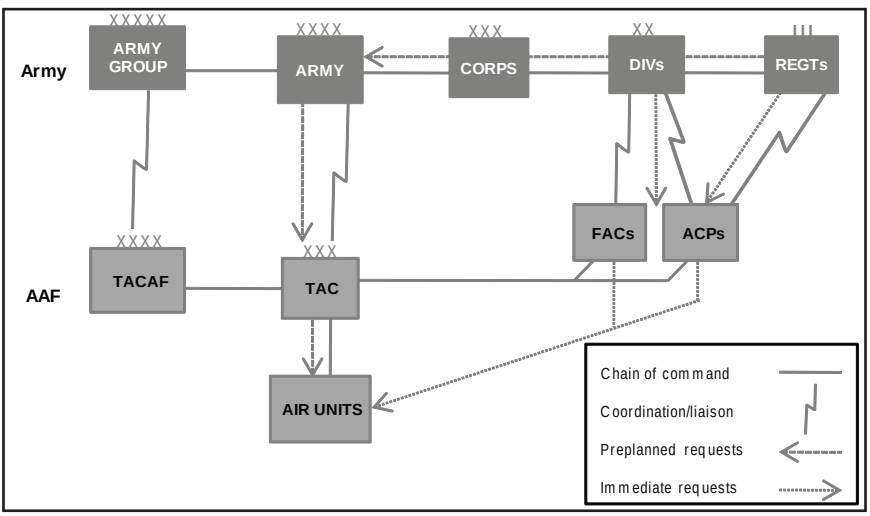


Figure 10. World War II Air-Ground Operations System.

The most prominent figure in American tactical air operations in World War II was Major General Elwood "Pete" Quesada, commander of the IX Tactical Air Command, which supported the US First Army. Quesada was an unusual AAF officer. He had not served in World War I and, while a pilot, had had a series of unorthodox assignments as an intelligence officer, attaché, and aide. He did not command an air unit until 1941 but gained experience commanding fighter units in the early years of the war.

Quesada proved to be a great innovator as commander of the air assets supporting the First Army. RAF and other AAF units later adopted many of his techniques. The methods of the IX TAC would form the basis for the postwar CAS manual. Quesada refinements included the placement of an ACP officer with a VHF radio in a tank at the front of a column while stationing a continuous rotation of a flight of fighter-bombers over the column to attack any enemy forces threatening the column under the direction of the ACP officer. Quesada commanded the air cover over the American invasion beaches on D-day and used all available air sorties to repulse the German counteroffensives at Mortain in August 1944 and in the Ardennes in December 1944.[39]

The redesignation of the Ninth Air Force's TACs from fighter commands shows that the TACs were primarily composed of fighter units. While the Army Air Force had developed a series of attack aircraft in the interwar period, this program waned in the years before the war. In

recognition of German air successes in 1939–1940, the AAF Air Force Combat Command (AFCC) (the retitled GHQ Air Force) approved the A-32 Brewster dive-bomber, a variant of the Navy's SB2A Buccaneer in the CAS role. However, the AAF phased out the A-32 almost immediately. The only CAS plane deployed with the AAF during the war was the A-36 Invader dive-bomber, a variant of the P-51 fighter, which served in the Mediterranean theater.[40]

By 1944, multifunctional fighter-bomber aircraft had supplanted light bombers and specialized attack aircraft in the CAS role. When Congress placed a moratorium on aircraft development in 1944, it assured that fighter-bombers would continue in this role for the rest of the war. The fighter-bombers were fighters originally designed for air superiority and bomber escort missions, which were reconfigured as dive-bombers. The primary aircraft conducting these missions in the ETO were the P-38 Lightning, P-47 Thunderbolt, and P-51 Mustang. The fighter-bombers were armed with a combination of machineguns, bombs, cannons, and, later in the war, rockets. The P-47, a former bomber escort, was armed with 8 .50-caliber wing-mounted machineguns, 3 bomb racks capable of carrying 1,500 pounds of bombs, and 10 five-inch rockets. The Thunderbolt was considered the most successful CAS platform in the war.[41]

US Air Force photo

Figure 11. P-47 Thunderbolt.

While fighter-bombers carried massive aerial firepower, the bombs of the era were not precision weapons. After-action analysis cited aerial bombs as having only a 45-percent probability of landing within 150 yards of the target. Accuracy increased when the target was a clearly identifiable feature, such as a bridge or building, but decreased against field positions

of ground troops. Air-to-ground rockets were more accurate, with a 90-percent accuracy rate against troop targets. Studies stressed that rockets were, however, more valuable for their morale effect rather than materiel damage to the enemy. Aerial cannons and machineguns were far more accurate than bombs.[42]

Aerial bombardment of the World War II era was, therefore, similar to artillery fire in that it was an area fire weapon. The major difference between artillery fire and aerial bombing was the ability of the bombers to drop a massive amount of bombs at once. Analysis of such attacks demonstrated that, similar to artillery neutralization, the principal effect of such an attack was its ability to disorganize and demoralize the enemy.[43]

This result was particularly apparent against armored or vehicle columns. Massed volleys of aerial rockets or bombs could stall whole panzer attacks. The disorganization effect could be far out of proportion to the actual damage inflicted as the German defenders had to halt, take cover, and then assess the damage after the strike. A large strike from Quesada's IX TAC at Mortain on 7 August 1944 stopped a German tank attack in its tracks. A later analysis of the battlefield showed that only a third of the German tanks were destroyed or disabled in the air attack.[44]

Recent scholarship has revealed more accurately the effects of airstrikes on German armored units in 1944. Conventional wisdom has long contended that the carpet bombing on 25 July 1944 at the start of Operation COBRA had effectively destroyed the *Panzer Lehr* Division.[45] In the whole Normandy campaign, the division lost 7,411 soldiers, mostly from the division's two infantry regiments. This represented 50 percent of the personnel assigned to the division at the start of the campaign. Counting replacements received during the campaign (3,437), the division's personnel losses during the campaign represented 41 percent of the division's strength. In terms of personnel, the division was at 83-percent strength at the time of the COBRA bombardment. During the carpet bombing, the division and its attached parachute regiment lost as killed or wounded roughly 1,100 men. This represented 74 percent of the personnel losses inflicted on the division in the month of July 1944. The disruptive effects of the carpet bombing were reflected in an estimated 1,400 *Panzer Lehr* troops being reported as missing in action after the bombing. Clearly, the carpet bombing was devastating to the personnel of the *Panzer Lehr* Division. But the losses, while representing three out of every four casualties suffered in a 30-day period, still only corresponded to 7 percent of the division's personnel complement.[46]

In terms of the materiel effects of the COBRA attack, the *Panzer Lehr* Division had 31 combat-ready tanks, only 17 percent of the 183 tanks that the division contained at the start of the campaign. Another 30 tanks were in maintenance shops. On 1 August, after the carpet bombing and the subsequent breakthrough operations, the division reported 27 tanks combat ready. Most of the tanks in the maintenance shops had been lost in the speed of the American advance.[47]

World War II CAS bombing was capable of inflicting devastating effects on personnel, particularly infantry. The actual effect on armored elements, such as tanks, was far less. However, the disruption effects on such forces were considerable. Prompt action by attacking ground troops could exploit this effect, creating the same result as if the armored vehicles had been destroyed. On 5 August 1944, after leaving behind a battalion-size battle group at the front, the bulk of *Panzer Lehr* withdrew to the rear to refit and reorganize. The bulk of the division was out of action until it had to retreat as part of the German withdrawal across France on 16 August.[48]

In World War II, therefore, CAS bombings resembled "aerial artillery" in their ability to neutralize or disorganize the enemy. Unlike artillery, however, the aviation could range far from the battlefield and immediately attack, suddenly appearing to moving targets such as vehicular columns. Aircraft could also augment bombing with machineguns and cannons. In the ETO campaign, opportunistic strafing attacks wounded or killed many senior German officers.

Nowhere did close air support compare with artillery bombardment more than in the carpet bombing that was a prelude to Operation COBRA in July 1944. COBRA was the successful operation designed to break out from the close terrain of Normandy into the more open country of central France. In COBRA, theater AAF commander Major General Carl Spaatz massed 2,450 bombers, including all the strategic bombers from the Eighth Air Force (also commanded by Spaatz), which were diverted from the strategic bombing campaign and all the bombers and fighter-bombers from the Ninth Air Force. This force, supported by 21 field artillery battalions (with 140,000 rounds to fire), was to bombard a 4- by 2.3-mile section of the German front line south of Saint-Lô for 80 minutes. The field artillery would follow once the attack began.[49]

Miscommunication resulted in a fractured bombardment. When the theater air commander postponed the attack because of overcast weather,

some of the bombers did not get the message and bombed anyway. Nevertheless, on the next day, 25 July 1944, the complete bombardment and attack took place. The breakthrough took place within 3 days and the breakout from Normandy quickly followed.[50]

COBRA showed one of the hazards of close air support in World War II—the danger to friendly troops from airstrikes. Despite extensive measures taken to protect friendly troops, on both 24 and 25 July 1944, heavy bombers dropped bombs on American troops. In the first case, a lead bomber accidentally dropped part of its bomb load prematurely and the rest of the formation did so too as the action of the leader was the signal to do so. In the second case, human error caused 77 bombers to drop their loads inside American lines. Altogether, 135 soldiers were killed and 621 were wounded. The casualties included an infantry battalion staff, a field artillery battalion FDC, and parts of three infantry companies slated for the first assault wave. As a result, theater commander General Dwight Eisenhower decided to never again use heavy bombers in a CAS role.[51]

Fratricide was usually coordinated using control measures, primarily the bomb safety line, a line drawn on the map in front of friendly troops behind which boundary aircraft could not bomb. The bomb safety line had to be selected carefully so as not to provide the enemy with too large a zone free from air attack. An additional close cooperation line was added later. While coordination and communications means had greatly improved since the early days of military aviation, it was still difficult to coordinate air and group operations in World War II.[52]

Although, for the most part, the process was improvised, close air support in the European and Mediterranean theaters set the standard for such future operations in later wars. The techniques used in the ETO would later become doctrine. Although organizational names, priorities, and aircraft may have changed over time, the basic approach to close air support developed in the ETO in World War II has continued to the present day.

Many of the interservice issues that were not problematic because of Allied air superiority and an availability of aircraft were submerged during the ETO campaign. These issues, such as the prioritization and centralization of air missions, would surface in eras without mass mobilization and assured air superiority.

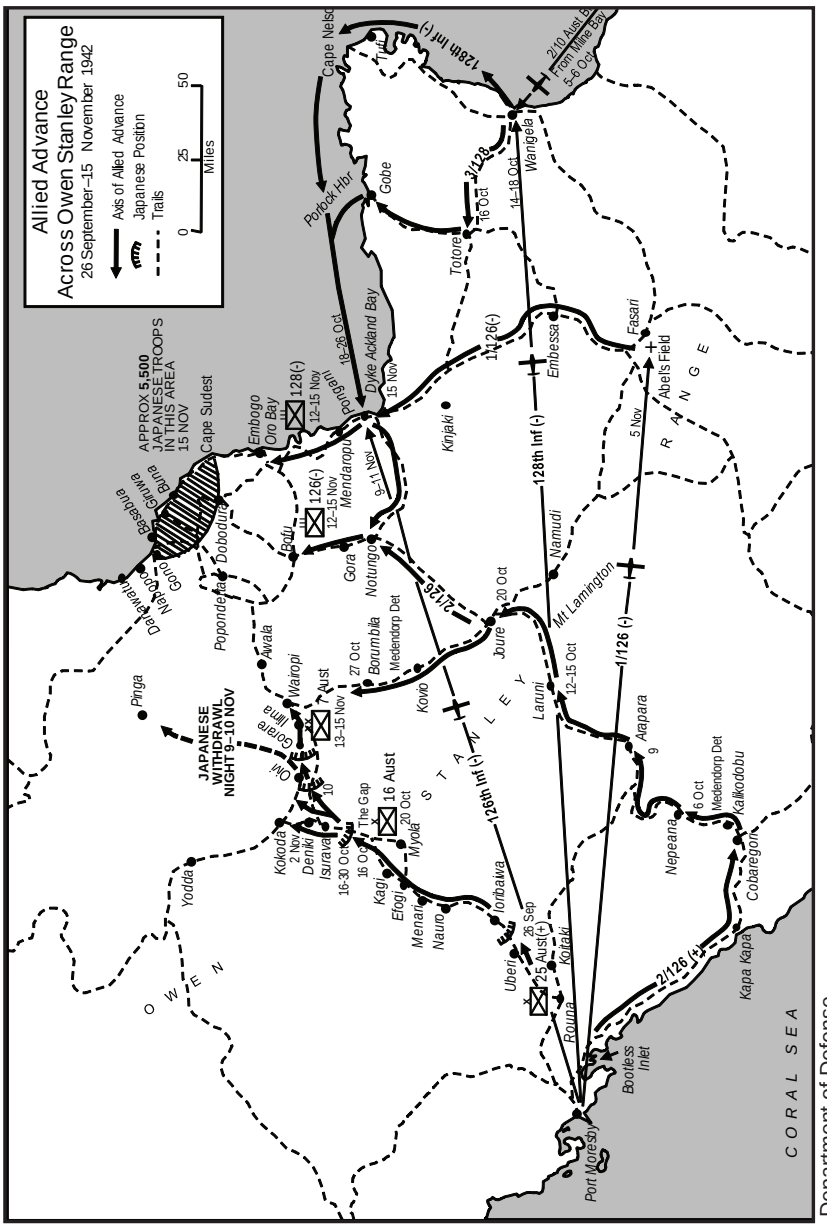


Figure 12. First phase of the Battle of Buna.

Close Air Support in the Pacific and the Battle of Buna

According to Major General George C. Kenny, "The artillery in this theater flies."[53]

Although the combat was equally intense, the terrain in the Pacific war was far different from that of Europe. The weather was more extreme in the tropics, and thick jungle vegetation made targeting more difficult and fratricide easier. Figure 12 shows the Battle of Buna.

General Douglas MacArthur commanded the major Army theater in the Pacific, the Southwest Pacific Theater, in World War II. Supporting his command was the Fifth Air Force commanded by Major General George C. Kenny. Kenney was a longtime aviator who had possibly shot down Hermann Göring in World War I.[54] After the war, he became the first commander of the Strategic Air Command (SAC). During the war, he worked closely with MacArthur for more than 3 years. MacArthur entrusted Kenney with centralized control of all the air assets in the theater. To keep his headquarters close to MacArthur, Kenney, in turn, delegated much of his daily operations to a subordinate equally trusted by the theater commander, Brigadier General Ennis Whitehead, who commanded the Fifth Air Force Advanced Echelon (ADVON). Although organized conventionally, Whitehead preferred issuing general guidance directly to group commanders, with daily updates, and using his fighter and bomber commands as subcommanders for specific operations. The Fifth Air Force never deployed a TAC headquarters during the war.[55]

(A-24) US Air Force photo
(Airacobra) Air Force Historical Research Agency

Figure 13. The Douglas A-24 Dauntless (left) and the Bell P-39/P-400 Airacobra (right).

The Fifth Air Force used different aircraft for close air support than were used in the ETO. The Fifth Air Force used the Douglas A-24 Dauntless, a ground version of the Navy's SBD dive-bomber, in 1942 but soon found it was too vulnerable in air-to-air combat. Its replacement was the Bell P-39/P-400 Airacobra. Although designed as a fighter, the

Airacobra proved to be more suitable in a ground support role. First used on Guadalcanal, it carried a 20-mm or 37-mm cannon in its nose and a 500-pound bomb under its fuselage.[56]

In mid-1942, the seemingly relentless Japanese advance across the Pacific was slowed with the strategic American victories at the Battle of the Coral Sea in May and at Midway in June. Allied offensive action then began with the landing of US Marines on Guadalcanal in early August. The second major offensive operations took place when US Army infantry forces assaulted the Japanese bridgehead at Buna in Papua on the northeastern coast of New Guinea in November. The first group of forces to assault Buna did so without field artillery support and was repulsed.

The Japanese had attempted to complete the conquest of New Guinea in early 1942. The US Navy stymied them at sea at the Battle of the Coral Sea in May. On land, Australian troops did the same along the Kokoda Trail in Papua between April and September. At that time, their forces retreated into an enclave around the port of Buna. MacArthur decided to counterattack and destroy the Japanese strongpoint as the first step in an Allied counteroffensive in New Guinea.

For ground units, MacArthur had available only the two infantry divisions of the I Corps, the 41st and the 32d. The 41st had been in the theater longer and was more acclimatized and had already been conducting jungle training. Major General Robert Eichelberger, the I Corps commander, however, selected the greener 32d for the operation because the division was already slated to be moved to a new training camp and he did not want to disrupt its training.[57]

The force for the operation consisted of the four brigades of the Australian 7th Division and two regiments (126th and 128th Infantry) from the US 32d Infantry Division. The two regiments were reinforced with signal, engineer, and medical assets. However, the two field artillery battalions that would normally support the regiments were left behind along with a third of the units' organic 81-mm mortars.[58]

The decision not to deploy artillery with the 32d Division elements was primarily one of expediency. The American troops would be transported to New Guinea by the limited air and sea transports available in the theater. Not taking along the artillery was a risk, but MacArthur and his staff felt the Japanese were weak at Buna and the AAF forces in the theater could make up for the shortage. Also, the Australians already had guns deployed in New Guinea.[59]

The plan to attack Buna was to move forces along three different axes, which would converge and surround Buna. On the left (west), the Australians would move along the Kokoda Trail, the direct route to Buna from the Allied base at Port Moresby and attack two smaller Japanese bridgeheads north of Buna. In the center, the 126th Infantry would advance overland to Buna from the southwest. The 128th Infantry would be sealifted and airlifted to the northern Papuan coast south of Buna and advance on the port from the south along the coast.

The troop deployment took over a month. Most of the American troops were shifted forward by air transportation. Only one battalion of the 126th Infantry ended up marching overland. The rest of the regiment was moved by air to a previously unknown forward airstrip that was improved for military use. The bulk of the two regiments closed on the coastal town of Pongani, 30 miles south of Buna by 12 November. The two regiments then advanced on the Japanese position with the 128th Regiment on the coast and the 126th Infantry on its left on a parallel track 10 miles inland. The Australians reached Wairapi on the Kokoda Trail 30 miles west of Buna on 15 November after fighting Japanese rearguards along the trail since 26 September.[60]

The three axes soon converged along the Japanese entrenchments around Buna, with the Australians shifting to the north to attack the other two bridgeheads. The 32d Division commander, Major General Edwin Harding, ordered the first of five unsuccessful attacks over the next 10 days on 19 November. The Japanese had made excellent use of the terrain in plotting out their defenses, and Harding was only able to attack in separate battalion and company attacks.[61]

Close air support in the form of light bombers was supposed to assist the 32d in these attacks. But early air attacks proved to have minimal impact as the rugged jungle terrain made targeting difficult and there was no direct air-ground communications. At times, only fighters appeared over the battlefield. Bombers were not available. The fighters had difficulty finding targets to strafe. Eichelberger later commented that air support disappointed him at the beginning of the campaign and was unable to locate Japanese bunkers or damage them once they were found. In his after-action report for the operation, not unexpectedly, he commented that "ground-air support control should be under the command of the ground forces commander."[62]

However, although Kenney had directly asserted that close air support would substitute for artillery support, postwar analysis indicated that, of the

approximately 800 sorties flown during the Buna operation, only a small number were actually committed to CAS missions. And, for the most part, these were either poorly executed or poorly coordinated with the ground forces. The blame for this was with both air and ground commands. In one case, an attacking infantry unit did not even receive its orders until after the airstrike that was supposed to immediately precede the attack had been executed.[63]

Later in the war, similar-size CAS sorties were far more effective than those at Buna. Attack density was not the reason for the ineffectiveness of close air support in 1942. Postwar analysis indicated the main factor in the failure of CAS at Buna was ineffective target identification. The Fifth Air Force did not yet deploy air control parties with the ground troops to help direct munitions onto the targets. Liaison stopped at the New Guinea force headquarters, the Australian command responsible for all Allied operations in New Guinea. This headquarters coordinated with the Fifth Army ADVON headquarters.[64]

The need for ACPs and closer coordination between air and ground at division and regiment levels was one of the primary lessons learned of the Buna campaign. The Fifth Air Force and other AAF elements in the Pacific, as happened in the Mediterranean theater at the same time, created ACPs and air liaison officers that were used effectively in later campaigns.[65]

Artillery was not totally absent from the first phase of the Buna campaign. By 23 November, the Australians managed to deploy 4 light 25-pounder guns (87.6-mm) to an airstrip 12 miles south of Buna, which were soon in action to support the Americans. The first US artillery arrived, a single 105-mm howitzer, by airlift on 26 November. This piece supported Eichelberger's December attack, although its ammunition was greatly rationed. During his tenure in command, Harding did not request any additional artillery. He later cited the difficulty the command had to keep the meager number of guns in action supplied as it was and the difficulty in transporting cannons by air.[66]

In Harding's last attack, the five available artillery pieces fired a standard artillery preparation. However, the effect on the defending Japanese was minor. As soon as the barrage stopped, Japanese machineguns resumed fire and stopped the attack in its tracks. The 32d had not yet developed effective artillery procedures for use in the jungle terrain.[67]

After his retreat from the Philippines, MacArthur was eager for a victory. He was also overly optimistic at the start of the operation. A

communiqué from his headquarters on 24 November reported favorably of the attack by the fighters. When the campaign bogged down, he sent Eichelberger to the 32d Division headquarters on 1 December with the authority to make sweeping changes. Eichelberger promptly relieved Harding and several of the senior officers in the division. Ironically, he made the division's artillery commander the new division commander. Eichelberger also took direct command of the US forces.[68]

On 5 December, Eichelberger renewed the attack and was repulsed as easily as Harding had been before him. At this point, while maintaining pressure on the Japanese with limited objective attacks, he began reorganizing and consolidating his forces. On 11 December, the third regiment of the 32d Division, the 127th Infantry, arrived by airlift. All the available artillery supported attacks on the 18th and 20th, but the attacks failed. On the 18th, most of the Australian 18th Infantry Brigade and some Australian tanks arrived to reinforce the Americans. With these reinforcements, a continuous, if slogging advance, began on 20 December. Buna was finally overrun on 2 January 1943. Mopping-up operations continued throughout January.[69]

In the only definitively effective use of artillery in the campaign, on 25 December, the Australian infantry hauled forward one of the 25-pounders to use as an accompanying gun. With an observer high in a jungle tree, the gun destroyed a Japanese 75-mm gun by direct fire.[70]

Air support of a different type played a key role in the Buna campaign. All American operational movements were conducted by airlift. Supply was from the air as well. Given the conditions of late 1942, the operation could not have been executed without such air support. This was a first in the American military experience.

The Buna campaign was a rare World War II campaign where close air support was deliberately substituted for field artillery fire support. This was counterintuitive to the usual AAF position of using airpower where artillery could be used was frowned upon. However, the Buna campaign was conducted on a shoestring, especially at the start. While close air support was generally ineffective given the inexperience of the participants and the unique terrain, the limited artillery used in the campaign was equally ineffective. If more artillery had been brought into the action, there would have been less infantry and there is not assurance a larger force of artillery would have been effective. The same conditions that made close air support unsuccessful equally applied to the field artillery.

Summary

Although the bulk of the Army only participated in two campaigns, World War I brought the US Army into the modern era of fire support. In the interwar period, the field artillery improved on World War I tactics and techniques. Improved gunnery, the FDC concept, and the codification of the forward observer as the maneuver company artillery representative produced an artillery force that not only could follow a preprogrammed fire plan but also could provide responsive immediate fires and swiftly mass fires onto one target. When war came with its mass mobilization, the application of these developments made the field artillery a decisive force from the beginning of the war to the end.

Things went in a different direction in the Army Air Force. In World War I, American airpower was centered on providing support to the Army. While this continued into the interwar period the Air Service/Air Corps/AAF gradually shifted priority to a more independent role that emphasized strategic bombing, which, if as successful as its proponents claimed, would end the war without the need for close air support. However, as World War II approached, German success signaled a shift in focus to a recognition for the need for close air support. Accordingly, unlike in the infantry, close air support during the war was improvised. A combination of factors made this improvisation highly effective. Mass mobilization provided enough air force to go around. With air superiority attained, the AAF was able to conduct strategic bombing and support the ground troops at the same time. Wartime experience and close personal relationships between ground and air commanders at the higher levels perfected an excellent system. The availability of fighter-bomber aircraft, most originally earmarked for bomber escort or air superiority missions, was fortuitous and highly effective.

At the very end of the war, the fielding of the atomic bomb, however, had great consequences for the wartime status quo between the air and ground fire support that had been so successful in winning the war. Therefore, in the ensuing Cold War era, the dichotomy between field artillery and close air support would shift in a new direction.

Notes

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2. David Adams Shugart, 25–26, 47, 284–285.
3. David Adams Shugart, 50, 72–80, 285.
4. David Adams Shugart, 84, 86, 91, 94–96.
5. David Adams Shugart, 115–117, 121; James Sawicki, *Infantry Regiments of the US Army* (Dumfries, VA: Wyvern, 1981), 18. The cannon company concept waxed and waned during the war.
6. Shugart, 122, 124, 128–129.
7. Shugart, 133, 137.
8. Boyd L. Dastrup, *King of Battle: A Branch History of the US Army's Field Artillery*, TRADOC Branch History Series (Fort Monroe, VA: Office of the Command Historian, US Army Training and Doctrine Command, 1992), 175; Janice E. McKenney, *The Organizational History of Field Artillery, 1775–2003* (Washington, DC: US Army Center of Military History, 2007), 129, 136–137.
9. John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946–1973* (Washington, DC: US Air Force History and Museums Program, 2003), 20.
10. John Schlight, 22.
11. John Schlight, 20–23, 27.
12. John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946–1973* (Washington, DC: US Air Force History and Museums Program, 2003), 19, 22; Robert Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force*, vol. 1, *1907–1960* (Maxwell Air Force Base, AL: Air University Press, 1989), 50, 83. Observation units whose primary function was artillery spotting eventually fell under the Field Artillery branch and, after the creation of the Air Force in 1947, formed the nucleus of what later became the Army's Aviation branch.
13. Schlight, 29.
14. Schlight, 24.
15. Schlight, 24–27.
16. Schlight, 2817.
18. Phillip S. Meilinger, "Trenchard, Slessor, and the Royal Air Force Doctrine Before World War II" in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Phillip S. Meilinger (Maxwell Air Force Base, AL: Air University Press, 1989), 41.
19. John Bagot Glubb, *War in the Desert: An RAF Frontier Campaign* (New York: W.W. Norton, 1961), 69–70, 124, 130–131, 225.
20. Meilinger, 42–43.
21. James S. Corum, *The Luftwaffe: Creating the Operational Air War, 1918–1940* (Lawrence: University Press of Kansas, 1999), 138–139. 152–153.
22. Schlight, 29; Meilinger, 42.
23. Schlight, 29, 32.

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25. William E. DePuy, Tape, Briefing to US Army Infantry School Student Officers, Fort Benning, GA, 1982.

26. Shelby Stanton, *Order of Battle: US Army World War II* (Novato, CA: Presidio, 1984), 28–29; McKenney, 176–177.

27. Stanton, 30; Shugart, 128, 133, 146; McKenney, 161.

28. Shugart, 141, 149.

29. Shugart, 143–145.

30. Stanton, 29–30; Gudmundsson, 138; McKenney, 170.

31. Shugart, 162, 164–165.

32. Schlight, 32.

33. Schlight, 32–33.

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35. Michael Lewis, *LtGen Ned Almond, USA: A Ground Commander's Conflicting View With Airmen Over CAS Doctrine and Employment* (Maxwell Air Force Base, AL: Air University Press, 1997), 23–24.

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38. Lewis, 20; Schlight, 44.

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40. Lewis, 14, 22–23; Gooderson, 60.

41. Lewis, 23; Thomas Alexander Hughes, *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II* (New York: Free Press, 1995), 124, 128; Gooderson, 61, 63, 70, 73; *Jane's Fighting Aircraft of World War II* (New York: Cresent Books, 1998), 255.

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43. Copp, 75; Gooderson, 104.

44. Gooderson, 116.

45. For example, see Martin Blumenson, *Breakout and Pursuit*, The United States Army in World War II: The European Theater of Operations (1961; repr., Washington, DC: US Army Center of Military History, 2005) 248, "on 25 July… [the Panzer Lehr] division was about to cease to exist as an organized unit."

46. Niklas Zetterling, *Normandy 1944: German Military Organization, Combat Power and Organizational Effectiveness* (Winnipeg, MB: J.J. Fedorowicz, 2000), 384, 387–389.

47. Niklas Zetterling, 390.

48. Niklas Zetterling, 388–389.

49. Blumenson, 219–220.

50. Blumenson, 241.

51. Blumenson, 229, 236–237.

52. Lewis, 21.

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56. Richard P. Hallion, *Strike From the Sky: The History of Battlefield Air Attack, 1911–1945* (Washington, DC: Smithsonian Institution Press, 1989), 165–166; Lewis, 22.

57. Jay Luvaas, "Buna, 19 November 1942–2 January 1943: A 'Leavenworth Nightmare,'" in *America's First Battles, 1776–1965*, eds. Charles E. Heller and William A. Stofft (Lawrence: University Press of Kansas, 1986), 193.

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62. R.L. Watson, "Air Action in the Papuan Campaign 21 July 1942 to 23 January 1943," Army Air Force Historical Study No. 17 (Historical Division, Assistant Chief of Air Staff, August 1944), 87; Eichelberger (Robert L.), interview, US Army Military History Institute, October 1947; Luvaas, 209; Extract, "Report of the Commanding General, Buna Forces, on the Buna Campaign, 1 December 1942–January 25, 1943," 57, 74.

63. "Close Air Support in the War With Japan," 9–10.

64. "Close Air Support in the War With Japan," 3, 10–11.

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66. Luvaas, 209; Watson, 88; Harding Interview, 11–12.

67. Harding Interview, 20; "Close Air Support in the War With Japan," 9–10.

68. Watson, 87.

69. Luvaas, 214, 216, 219–220.

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Chapter 3

Field Artillery, Attack Aviation, and Close Air Support from 1945 to 1975

In World War II, the US Armed Forces developed techniques and procedures that maximized the effective use of close air support and field artillery firepower in a high-intensity battlefield environment. The field artillery applied and tweaked the techniques and organizational structures it had developed in the interwar period. In the postwar era, most artillerymen believed that only minor changes, such as the formalization of the company FO concept, were needed, at least for the near future.

Things were different in relation to close air support. While the AAF had performed well in the tactical role during the war, air officers still focused on the strategic bombing mission, a campaign that had been conducted concurrent with the tactical one in both the European and Pacific theaters. The AAF interpretation of these air campaigns was supremely positive. That the war ended without the need for a ground invasion of Japan and through the employment of atomic weapons carried by AAF strategic bombers increased this feeling exponentially.[1]

After the war, therefore, and particularly after the Air Force became a separate service in 1947, the Air Force senior leadership depreciated close air support. When the Air Force split off from the Army, almost all Army functions concerning aviation went with the new service. This included tactical aviation. With the advent of nuclear weapons and the AAF's analysis of strategic bombing in the war as justifying all theory, close air support became a low priority to the Air Force. Ironically, therefore, while the new service controlled all military aviation, including close air support, it did not want to do close air support. However, concerned with its roles and missions, and true to the principle of centralization of all air assets, it did not want the Army to perform it in its place either.

Over time, this difficult situation resulted in many compromises. One was the creation of Army attack aviation helicopters. The Army gradually transformed the small fleet of aircraft it retained, artillery observation craft, into a fleet of helicopters. And, eventually, the helicopters received a combat mission. In Vietnam, the Army first used helicopters as "aerial artillery," a sleight of hand to conceal that such aircraft were actually performing CAS missions. The Army then developed the attack helicopter, a specialized aircraft designed to conduct ground support missions. While the Air Force continued to have the CAS mission with fixed-wing aviation,

the Army's rotary-wing attack elements eventually developed the concept of an independent mission as well, the deep attack. Air Force close air support gradually moved toward more precise munitions away from the 1940s gravity-aimed bombs to expensive rockets, missiles, and guided bomb systems.

Meanwhile, the field artillery remained tied to the units it supported while technological advances, primarily computerization and digital communications, as well as the fielding of better cannon and vehicle systems, modernized the arm.

Postwar Field Artillery and the Korean War

After World War II, the US Army, including the field artillery, rapidly demobilized. The only major organizational changes in the postwar period were the standardization of the fire direction center and the FO system and an increase in guns in DS batteries from four to six. During the war, the company FO concept was adopted on an ad hoc basis. In an infantry division, DS field artillery battalions had to create three FO parties and one battalion and one regimental ALNO party out of its pool of liaison and company officers. Officers were often rotated through these roles. Revised postwar tables of organization made the positions permanent and authorized enough additional officers and enlisted men to permanently staff them. To coordinate and mass fires, the Army authorized FDCs for all artillery units from battery to corps artillery headquarters battery levels. The reorganization began in 1948 and was still being implemented across the Army when war came again.[2]

The Korean War started suddenly on 25 June 1950. The postwar Army was understrength and ill prepared. The DS field artillery battalions in Japan that were the first sent into action had only two batteries each. This initiated one of the major recurring themes of the war: not enough guns. Given the enemy's massed infantry attack tactics and the long fronts held by United Nations and American forces, particularly in the initial mobile phase, and the static front held later, field artillery played an important role in combat operations. Nevertheless, there were never enough guns.

There was a shortage of guns in the Korean War for two reasons: not enough units and not enough ammunition. A shortage of firing units was apparent from the start. As early as 13 July 1950, theater commander General of the Army Douglas MacArthur was asking for additional artillery. He expected to have to hold an extended front and wanted to provide each infantry regiment, operating as a regimental combat team, with a 155-mm battalion in addition to its 105-mm DS battalion. The

artillery buildup was slow, but by July 1951, the number of battalions equaled early war expectations.[3]

However, MacArthur's successor General Matthew Ridgway wanted even more firing units. In the attack, the Chinese and North Korean enemy often presented large infantry targets against which massed artillery fires were effective. The Army depleted its general reserve and cut reinforcements to Europe to give Ridgway the forces he wanted. Nevertheless, the number of artillery units deployed to Korea never reached the levels of such units in the ETO in World War II. During the static phase of operations (1951–1953) in Korea, up to 20 nondivisional artillery battalions supported UN forces holding a 150-mile front. Along a similar front in World War II, the Army would have typically employed between 50 and 60 such battalions. Additionally, in the latter 2 years of the war, the enemy increased its artillery forces almost 200 percent, achieving virtual parity in number of guns where the UN had originally had a more than 2-to-1 advantage.[4]

While there seemed to be never enough guns, ammunition shortages exacerbated this effect. Underestimation and slow production were the main culprits. World War II usage rates were the basis for ammunition loads. But the shortage of guns meant that each gun fired more rounds. In 10 days at the Battle of Soyang in May 1951, 20 artillery battalions fired 381,136 rounds. In contrast, during a similar period at Bastogne in December 1944, 35 artillery battalions fired only 94,230 rounds.[5]

The remaining World War II stockpiles, particularly of 105-mm ammunition, were depleted, but production, now keyed into peacetime prosperity, could not quickly replace them. By the spring of 1952, there was an ammunition crisis that took almost a year to resolve. In the interim, heavy artillery (not affected by the crisis) and close air support had to step in and play a larger role in fire support.[6]

In Korea, the field artillery reaffirmed its versatility and importance as a component of the combined arms team. In the rugged terrain of the Korean Peninsula, most operations used predominantly infantry forces. The Communist enemy, particularly with a shortage of its own artillery in the first part of the war, preferred large infantry attacks. As related in chapter 2, field artillery fire effects were particularly devastating against personnel targets. Massed artillery routinely broke up Communist "human wave" style attacks. New munitions, such as the proximity fuse, fielded late in World War II, which rained shell fragments onto the enemy from low airbursts, increased the antipersonnel effectiveness of artillery.[7]

A deficiency of guns was one of the conditions under which even air officers felt that using airpower was an acceptable replacement for using field artillery. Before artillery could land and deploy, Quesada's planes provided much of the fire support to the D-day invasion. In 1950, the new United States Air Force (USAF) was far less prepared for the CAS mission than it had been in 1945. Nevertheless, by 1952, as in World War II, things had recovered to the point that air support successfully covered for the shortage of guns and ammunition.[8]

Close Air Support in the Cold War Air Force

The immediate postwar period was one of transition and transformation for the Army Air Force, which became the United States Air Force in September 1947. The new independent service justified its existence based on strategic bombing. While strategic bombing was, accordingly, the priority in the USAF, the service controlled all land-based military air functions. As such, tactical air support remained an important mission. Despite the advent of atomic warfare and the emphasis on strategic bombing, the AAF/Air Force took two steps in the immediate postwar years that seemed to recognize the importance of close air support. First, in 1946, the AAF published its postwar manual on close air support that codified the techniques Quesada had developed in the IX Tactical Air Command in the ETO. In August 1946, the AAF produced FM 31-35, *Air-Ground Operations*. The field manual set up the procedures for close air support used later in the Korean War (figure 14).[10]

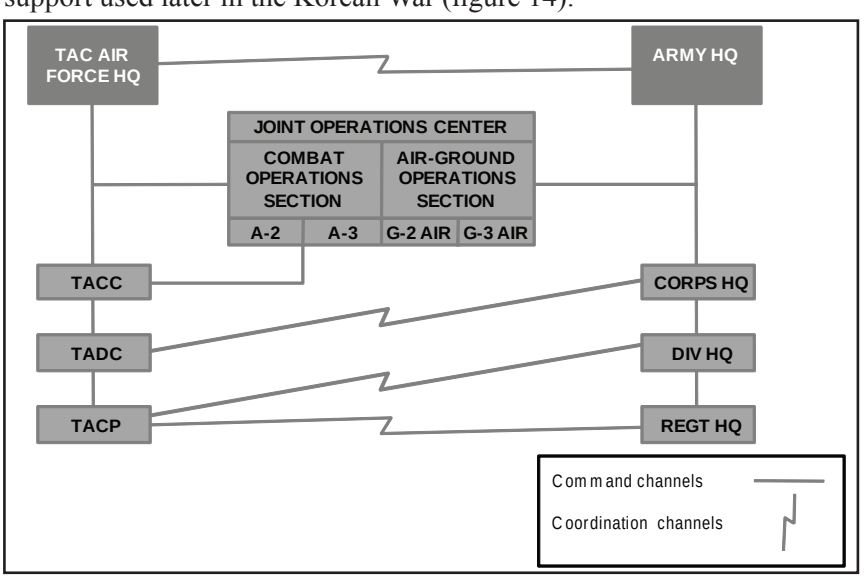


Figure 14. The Air-Ground System, 1950.[9]

Numbered tactical air forces (TAFs) replaced the numbered tactical air commands of the ETO. Accordingly, the TAF coordinated air operations in support of a field army.

This was the lowest level of coordination for most air requests. At the TAF and army command post, the staffs formed a joint operations center (JOC) consisting of the TAF operations (A3) and intelligence (A2) sections and the field army's air operations (G3 air) and air intelligence (G2 air) staff sections. Requests for air missions moved up the Army through the S3 air/G3 air at each echelon up to the JOC.[11]

The TAF also formed two other coordination elements, the tactical air control center (TACC) and the tactical air direction center (TADC). While the JOC approved, prioritized, and planned air missions, the TACC controlled the execution of preplanned air missions. There were no air coordination elements below the army level. But there were pilots serving as air liaison officers on division and regimental staffs.[12]

The TACC, however, sent out tactical air control parties (TACPs) as necessary to direct aircraft to ground targets near the front lines. TACPs were formalized ACPs of World War II. Their allocation was situationally based. A forward air controller (FAC) headed each TACP. As necessary, the TACC also employed an airborne tactical air controller. TACPs coordinated with ground division, regimental, and battalion headquarters to control both preplanned and immediate (now called air alert) missions. TACPs typically operated from forward observation posts.[13]

The TACC also, as necessary, created an element called the tactical air direction center (TADC). The TADC usually collocated with a corps artillery fire direction center and controlled any air missions in restricted space, such as a bomb safety line (BSL). Air attacks beyond the BSL did not require any ground coordination. The TADC coordinated those inside it.[14]

For responsiveness, the JOC allocated a number of air alert sorties. These were preplanned sorties of strike aircraft that loitered near the front lines. When there were no available air alert sorties, immediate calls for air support went through Army channels to the JOC, which decided whether to reallocate air assets or deny the mission. To streamline the process, the TACC usually allocated certain air alert sorties directly to the TADC or to a FAC for use against targets of opportunity. The most responsive air alert mission was the column cover where tactical aircraft, under the direction of a FAC, flew over a moving column to provide immediate support in case of enemy contact.[15]

The second major initiative was the creation of the Tactical Air Command (TAC) in March 1946 as one of several major functional commands that the AAF created in preparation for becoming a separate service. Based in the continental United States, TAC had responsibility for training and fielding air units whose main function was tactical support. Quesada, now a lieutenant general, became the first head of the new command.

TAC's original order of battle included three numbered air forces and a large fleet of fighters and fighter-bombers. One air force controlled the service's fleet of troop carrier aircraft. The other two were TAFs, as mentioned previously, now an echelon roughly equivalent to the wartime numbered TACs designed to work with field army headquarters. One TAF was a mix of light bombers, fighters, and reconnaissance planes. The other TAF contained four squadrons of the newly fielded P-80 Shooting Star, the first American jet fighter.[16]

Quesada put his mark on TAC from the start. In addition to getting FM 31-35 published, he moved his headquarters to Langley Field in Virginia to be close to the Army Ground Forces (AGF) at Fort Monroe. Under Quesada's leadership, the Strategic Air Command conducted three joint exercises in 1947. Quesada, however, saw that the establishment of TAC was illusionary. In the reduced budgets and promotion opportunities of the early days of the Cold War, the Air Force's major bomber command, SAC, received the priority, including 65 percent of the first Air Force budget. In terms of operational forces, the organizational structure greatly favored the big bombers. Quesada disputed the ratio of forces in the new service as not reflecting wartime realities. After the final round of demobilization, SAC contained 75 percent of the force compared to TAC's 25 percent.[17]

TAC was seemingly set up partially to obtain Army agreement to the creation of the AAF as a separate service. Army Chief of Staff Dwight Eisenhower and AAF head and first Air Force Chief of Staff Carl Spaatz had pledged to keep close air support a priority. But Spaatz retired in early 1948 and Eisenhower had become the President of Columbia University. It took only 13 months after the formal separation of the services in September 1947 for Spaatz' successor, General Hoyt Vandenberg, to downgrade TAC to a planning headquarters under a new major command, the Continental Air Command (CONAC) in December 1948.

The sudden outbreak of the Korean War reemphasized the importance of close air support. In the new environment of limited warfare, strategic bombing facilitated that limitation from the enemy side, but it directly

contributed to the ground fighting. The Air Force leadership had not anticipated limited warfare. What close air support assets that remained, Air Force Chief of Staff General Hoyt Vandenberg felt would only be needed if the strategic atomic offensive he envisioned had failed.[19]

US Air Force photo
(http://www.langley.af.mil/staff/ho/images/p80.jpg)

Figure 15. P-80 Shooting Star jet fighter.

Vandenberg had miscalculated. With American policymakers unwilling to execute an atomic offensive against the Soviets over the issue of Korea, close air support became important again. Within 6 months of the start of hostilities and only 2 years after its reduction in status, TAC was removed from CONAC and returned to major command status to manage CAS assets being deployed to Korea. CONAC became responsible for reserve air units. TAC thereafter remained a major USAF command until the postwar reorganization of the Air Force in 1992.

With the senior leadership of the Air Force clearly in the hands of strategic bombing supporters, Quesada had intended to retire when TAC was reduced in status. However, the Air Force leadership feared that his departure would send a negative message to Congress and the Army and refused his request until 1951. After retirement, Quesada became the first head of the Federal Aviation Administration (FAA) and the original owner of the expansion Washington Senators baseball team. Lieutenant General Otto Weyland, who had led the XIX Tactical Air Command in support of Patton's Third Army in World War II commanded the revived TAC.[20]

US Air Force photo

Figure 16. F-82 Twin Mustang.

As it had in 1940, the outbreak of war halted the downward trajectory of close air support, when North Korea attacked South Korea in late June 1950. In Japan and the western Pacific, the Far East Air Force (FEAF) had a force of five wings of F-80C jet fighters and F-82 Twin Mustang fighters, and a wing each of B-26 Marauder bombers and B-29 Superfortress bombers. The Air Force later used its transition to war in 1950 as a model for the adaptability and flexibility of the service. Two days after the invasion, a fighter group began operations in Korea. Within a month, all available aircraft had moved within range of the battlefront. Aircraft from the states, mostly B-29s and F-51 Mustangs arrived as reinforcements as well.[21]

For the first month of the war, FEAF assets substituted for the heavy artillery the Army's Eighth Army was lacking. Reflecting this situation, 62 percent of sorties in this period were CAS missions. Since North Korea had a small Air Force, less than a quarter of the missions involved air superiority, with the remainder being interdiction tasks. The F-80s and B-26s flew most of these sorties, but even the B-29s were used for close air support in the early going. The B-29s, however, had the same problems

of target identification and fratricide seen in Operation COBRA.[22]

Per USAF doctrine, the FEAF commander, Lieutenant General George Stratemeyer, with the approval of MacArthur and the Air Force headquarters, became the commander of all theater air assets. Stratemeyer put the Fifth Air Force in charge of tactical air operations. Despite several attempts to decentralize the control of air assets supporting the ground troops, Stratemeyer successfully convinced MacArthur that all land-based air assets, including Marine aviation, be placed under his control. Initially, naval air support remained outside this system, but by 1952, it too was placed under FEAF control for operations against land targets.[23]

Army commanders, most prominently X Corps commander Lieutenant General Ned Almond, resisted the centralization of air assets. Almond desired the assignment in a direct support relationship of one fighter-bomber group to each combat division. Air operations in Korea were markedly different from the World War II experience. The war was not conducted under full mobilization. This meant that only a finite number of air assets were available. While in the previous war, the AAF was willing to be flexible in the employment of airpower, as Almond had experienced, in the new war they were unwilling to divvy out limited aircraft. General Joseph Collins, the Army Chief of Staff, agreed with Almond on decentralization. After failing to obtain Air Force agreement on this issue, Collins began pursuing efforts to either transfer the CAS mission to the Army or create a helicopter-based force to perform the mission.[24]

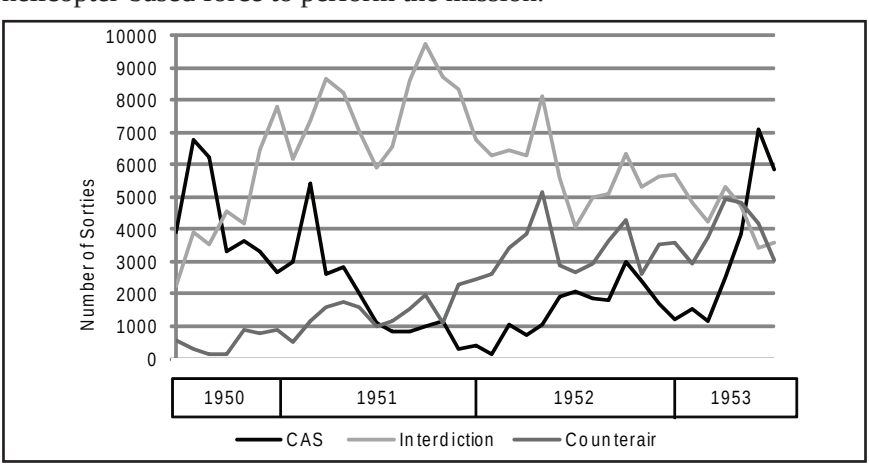


Figure 17. The course of the Korean War in air missions.[25]

The Air Force had acquiesced to prioritize CAS missions in the emergency situation at the end of June. By mid-July, the situation had stabilized and enough reinforcements, both air and ground, had arrived

that a shift in priorities seemed appropriate. This shift was mission based. In the three-phased air mission model and with air superiority assured virtually from the start of the war, the highest priority was now interdiction. By September 1950, interdiction became the most common mission for USAF aircraft (see figure 17), a position it held throughout the war until almost the end. Overall, for the whole course of the war, 55 percent of air sorties were interdiction missions. The rest were evenly divided between air superiority and CAS missions (see figure 18).[26]

With air superiority generally reassured, these statistics clearly reflect the Air Force's predilection for independent interdiction missions. While interdiction almost always took up the majority of missions in the war, the variations at different times reflected the operational situation at different times.

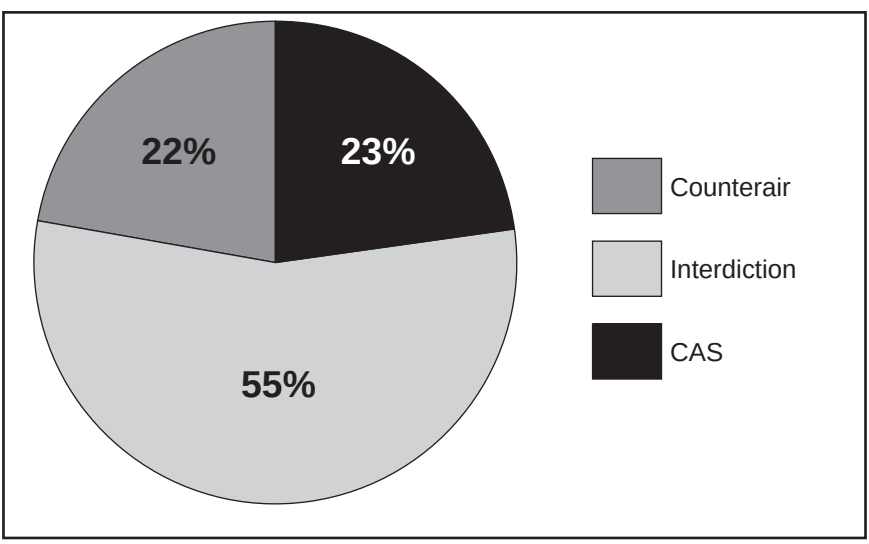


Figure 18. Apportionment of combat air missions in the Korean War.[27]

The preponderance of close air support in the first months of the war reflect the situation—the UN forces were on the defensive, first retreating, then defending the tight confines of the Pusan perimeter. In September, however, UN forces counterattacked and began pursuing the retreating North Koreans into that country. In this situation, FEAF priorities shifted to interdiction. In November 1950, the Chinese Communists entered the war on the side of the North Koreans. While this completely changed the ground situation, the air priorities remained the same. However, CAS missions also increased as well, as attention focused on stopping the Chinese advance.[28]

At times, air support proved to be decisive. At Kunuri, north of the North Korean capital of Pyongyang, the US 2d Infantry Division found itself forced to retreat down a narrow corridor surrounded by enemy-occupied ridgelines. Tightly controlled airstrikes, consisting of napalm and strafing, destroyed a Chinese roadblock and neutralized the troops holding the high ground enough for the bulk of the division to escape.[29]

In the spring of 1951, UN forces counterattacked, reaching a line close to the prewar boundary on the 38th parallel by July 1951. From this point until the signing of an armistice, effective 27 July 1953, the war was fought on a positional nature similar to World War I, with the difference being that UN forces were only trying to retain the status quo until peace could be secured. During this period, the need for continuous close air support decreased, except during the artillery ammunition crisis in the spring of 1952, and FEAF concentrated on interdicting Chinese supply lines. However, in 1953 with an armistice looming, the Communist forces began conducting vigorous operations to secure better positions. Accordingly, Fifth Air Force CAS operations spiked to sortie levels even higher than those of the summer of 1950 in the final 2 months of the war to help ground troops repulse these enemy efforts. While FEAF provided support to the Army throughout the conflict, Army commanders such as Almond remained skeptical as to the quality of this support.[30]

One of the main reasons that Almond complained was his belief that the new CAS system was not responsive to immediate missions. The war was the first test of the new air-ground system. Doctrinally, the Fifth Air Force needed to set up a joint operations center with the Eighth Army, which was done in July 1950. The JOC was collocated with the Fifth Air Force's headquarters and its operational element, the TACC. Eventually, the Fifth Air Force established several TADCs at corps headquarters to more closely control air missions.[31]

The main element in the system was the TACP, the Air Force equivalent of forward observers. Starting with two TACPs, by the end of the war, the Fifth Air Force was fielding between 48 and 50 such teams with the ground forces. A typical Army division had between four and six TACPs, meaning that roughly one or two teams were supporting each infantry regiment. Distribution was often uneven. In late 1950, Almond's X Corps had an average of 12 TACPs per division, enough to give a team to each infantry battalion, with several left over, while the rest of the Eighth Army averaged 4 teams per division. Almond's squeaky wheel received proportionally more air support assets although his mission was no more or less important than that of the bulk of the Eighth Army.[32]

The TACPs started slowly, with weak World War II surplus communications equipment and transportation. The gradual fielding of new radios and jeeps improved this situation. During the static phase of operations, the radios could now be remoted from vehicles into bunkers. Because of the early war TACP difficulties and the rugged Korean terrain, FEAC began placing FACs in aircraft.[33]

As early as the first week of July 1950, FEAC began using airborne FACs, nicknamed "Mosquitoes," to supplement or replace ground TACPs. The Mosquitoes used small light liaison and trainer planes. The airborne FAC concept quickly expanded, with 27 planes operational by September 1950 and 50 in April 1951. In the later period of the war, enemy air defenses reduced the role of the Mosquitoes. Because of their use of small, vulnerable aircraft, most Air Force observers felt that the airborne FAC did not have a future.[34]

The initial major weakness of the air-ground system in Korea was a combination of a lack of coordination and communications. Under the system, the Army was supposed to provide staff, communications equipment, and coordination support at various levels. A combination of the chaos of the early days of the war and the lack of readiness of the Eighth Army, including its ability to support CAS functions. As the war progressed, the system matured. This shifted the argument from one of organization to one of responsiveness.[35]

While the air-ground system adopted in 1946 in theory contained a provision for immediate air requests called air alert missions, in Korea this procedure was almost never used. Even immediate missions had to be sent from the forward element through the chain of command to the JOC at field army level. Almond believed that the complicated request system was not responsive and that the JOC too frequently changed or rejected requests.[36]

The war began with the USAF employing a mix of old World War II fighter-bombers and bombers and first-generation jet fighters. As operations continued, jets replaced the older, propeller-driven aircraft. By the end of the war, second-generation jet fighter-bombers began appearing on the battlefield. These airplanes executed both CAS and interdiction missions against ground targets.

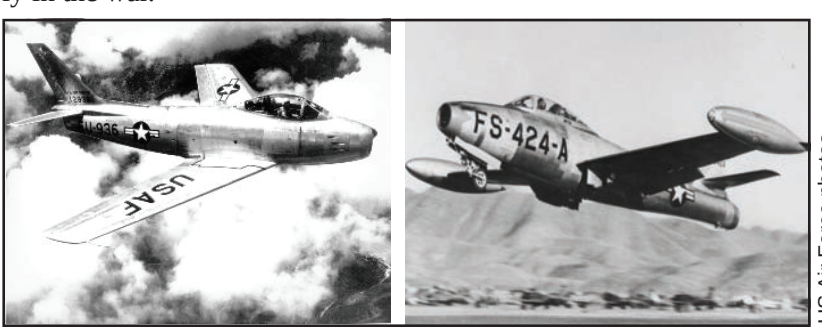
The first-generation jet, the F-80, worked well in the air-to-air combat role, but because of missing bomb racks and its short range, it proved to be less successful in the CAS role. By August 1950, the USAF began replacing a portion of the Shooting Stars with F-51 (née P-51 in World

War II) Mustangs for CAS operations. Later, the F-80s were upgraded and it became multifunctional. However, its range remained restrictive as it required longer and better runways that were only available in Japan.[37]

Table 3. CAS Issues in the Korean War[42]

1. Prioritization of air missions.
2. Control and tasking of air missions.
3. CAS command and control.
4. Types of aircraft.

Although an older design, the Mustang proved an effective CAS vehicle. The P-51 was able to operate from Korean airfields, making it more responsive, and was able to carry a more varied and lethal munitions load, including napalm, which had proven effective against both personnel and armored targets. The tactical situation mitigated against the Mustang's weaknesses in relation to enemy air and ground fire. Enemy fire and counterair capabilities were not significant enough during the tenure of the Mustang in the theater. The Twin Mustang, usually used in an air superiority role, also sometimes conducted CAS or interdiction missions early in the war.[38]



US Air Force photos

Figure 19. F-86 Sabre (left) and F-84 Thunderjet (right).

As the war progressed, the Air Force phased out the Mustangs and Twin Mustangs. The F-84 Thunderjet replaced the propeller planes as the primary ground attack aircraft in the middle of the war. The second-generation jet, the F-86 Sabre, began operations in the theater in early 1951 in response to the Chinese deployment of the MiG-15 jet fighter in the air superiority role. The F-86 replaced the F-80 in this role with the latter concentrating on CAS and interdiction missions. In the spring of 1953, the F-86 began replacing the F-84 in the ground support role as well. As in World War II, bombs remained the primary munition of

CAS/interdiction aircraft. The development of napalm, however, added a devastating weapon against personnel and vehicular targets.[39]

As in World War II, both field artillery and close air support played important roles in the success of ground operations. Field artillery never reached the typical numbers of firing units that were seen in World War II. This meant that batteries were more spread out than in the previous war, sometimes precluding the ability to mass artillery fires. In these cases and during the ammunition shortage crisis of 1952, CAS supplemented or replaced artillery fires.[40]

The Korean War, with its limited nature and American air superiority, brought a new twist on the debate between strategic bombing and tactical air support. In this case, with no real strategic bombing effort in a limited war, the contention between the Army and Air Force reduced itself into conflict within the sphere of tactical air support alone. The new contrast was between close air support, fires in direct support of the ground troops, and air interdiction operations, those conducted independent of the ground forces designed to indirectly affect the ability of the enemy ground forces to fight. The war also was an example of "reinventing the wheel." As in World War II, air-ground operations had to be relearned at the start of the war. From 1945 to 1950, there had been inadequate joint training.[41]

In his writings, Almond emphasized four points of difference between ground and air approaches to close air support exhibited in operations in Korea. These factors form a theme for using close air support to the present day. The first point, prioritization of air missions, was only an issue when there were a limited number of air assets. In World War II, it was not an issue; in Korea it was. With air superiority, air officers preferred to conduct air interdiction operations, while ground officers wanted close support. Air Force commanders felt they were showing a larger vision for operations than their Army counterparts. But interdiction also allowed air commanders to operate independent of the specific requirements of a ground commander.[43]

The second issue involved centralized or decentralized control of air assets. The Army favored the decentralized approach where air support was apportioned between subordinate units much like field artillery was operationally employed. However, the ground commander always controlled the field artillery. While there were sometimes disputes between the artillery commander and the unit he was supporting, as at Gettysburg, both individuals worked for the same ground commander. The Air Force since the days of Billy Mitchell had considered it axiomatic that airpower

had to be centralized and under the control of the air commander. Under the 1946 doctrine, this commander was that of the tactical air force. This level was four higher than that required for artillery support. In other words, while an infantry company commander could request artillery support from his forward observer, who could then directly call an FDC to get the fires, the same company commander had to request the air support through his battalion S3 air, who sent the request through the regiment, division, and corps to the JOC at field army, where the request could be rejected or approved. If approved, the local TACP would direct and observe the mission. The TACP would typically be working at the regimental level. Centralization made immediate responsiveness virtually impossible. While the USAF had a system to supply loitering planes for immediate missions, a combination of a shortage of planes and a lack of loitering capability usually precluded this in Korea.[44]

The third point, the control system for close air support, required constant and continuous joint training and interservice cooperation. This was lacking before Korea and in its early stages. Given the constant dispute of the relative importance of close air support, it would continue to be an issue in future decades.[45]

The final point was on the types of aircraft employed for close air support. Often, aircraft designed to fight other planes or to bomb strategic targets ended up being used in the CAS role. After 1947, the Army only had limited input into the development of aircraft eventually slated to conduct close air support. The Air Force valued airplanes that could do multiple missions, with primary focus on air-to-air combat. In Korea, jets replaced prop planes primarily because they were the best at shooting down other jets. This issue continued until the Air Force developed a CAS-specific jet, the A-10, in the 1970s.

The Eisenhower administration's adoption of the new look policy, which renewed the importance of nuclear warfare, soon overshadowed the events in Korea The lessons of limited wars such as Korea, which now seemed like anomalies, appeared less pertinent. In this new era, the Air Force again viewed its strategic mission, now based on a fleet of long-range bombers equipped with nuclear bombs, as able to deter both general war and limited wars. Again, within the service, interest in tactical air support waned.[46]

With the renewed emphasis on strategic airpower after the Korean War, the Army again felt unease at perceived Air Force neglect of close air support. A series of small steps over the next decade resulted in the creation

of a force of helicopters in the Army capable of conducting CAS missions. After many disputes over the proponency for rotary-wing aircraft, the Air Force agreed to the Army gaining this mission. As part of this process, the Air Force also developed the first modern aircraft designed specifically for CAS operations, the A-10, in the early 1970s.

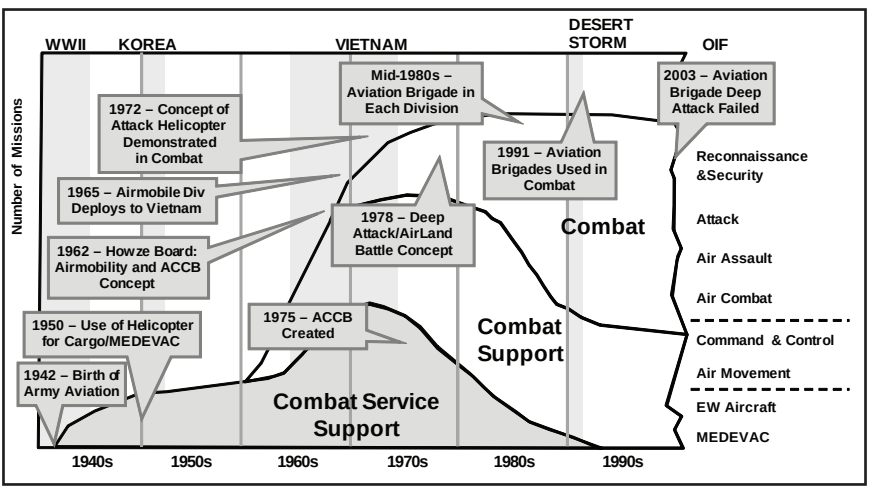


Figure 20. The evolution of Army aviation.[47]

The Army and the Attack Helicopter

In 1949, Pete Quesada predicted that, if the Air Force did not meet the Army's needs for close air support within 5 years, the Army would be able to justify the creation of its own air force. By 1954, the Army had, in fact, taken steps that would lead to creating such a force. Concurrent with the decrease in status of close air support in the new USAF, the Army began the early development of what would later become Army aviation.[48] Figure 20 shows the evolution of Army aviation.

The initial impetus in the development of Army aviation was based on the specific limitations placed on what aircraft the Army could develop and field. The National Defense Act of 1947 split the Air Force from the Army. Under the previous organization, while the Army-Air Force possessed great autonomy within the Army and the War Department, there were many grey areas in aviation-related roles and missions. These became much more distinct when the Air Force became a separate service. The act itself did not specify roles and missions between the services concerning aviation, although the committee report with the final version of the law contained the comment that the Army "is not deprived of certain types of aviation necessarily organic to the Army for the accomplishment of its functions."[49]

Because of the nebulous nature of the act, the first Secretary of Defense, James Forrestal, convened a meeting of the senior officers from each service at Key West, Florida, in March 1948 to spell out the specific roles and missions of each service. This was the first of a series of such meetings that redefined or refined the roles and missions of the Army and Air Force concerning Army aviation. These meetings eventually culminated in the Johnson-McConnell Agreement in April 1966, which in essence put the Air Force in charge of all fixed-wing aircraft and the Army the proponent for rotary-wing aircraft.[50]

The basic conflict between the Army and the Air Force in the intervening years was based on the inexact wording of both the National Defense Act of 1947 and the Key West Agreement. While recognizing the Army's need for organic air assets to conduct its missions, the definition of such assets was ill defined. The conflict between the services started almost immediately and continued through the Korean War and into the 1960s. The Army leadership, led by the Chief of Staff General J. Lawton Collins perceived that the Air Force leadership had relegated close air support to a role secondary to strategic bombing. Regard for the CAS mission was so low that, at one point, the Chief of the Strategic Air Command, Air Force General Curtis LeMay, fleetingly suggested that the Air Force give its tactical aircraft to the Army. Even the Tactical Air Command, the CAS branch of the Air Force, began emphasizing a theater-level nuclear capability.[51]

While the Army perception was based on USAF organizational restructurings and doctrinal writings, Air Force materiel procurement reinforced it. Newly developed fighter-bombers seemed to be less capable of providing close air support due to their multifunctional nature and an emphasis placed on their ability to carry nuclear bombs. When Collins suggested an Army role in aircraft design, he was rebuffed. A prominent contemporary Air Force tactical commander, Gabriel Disosway, although a later opponent of the Army armed helicopter, agreed that the Air Force emphasized the nuclear mission at the expense of providing support to the Army in the 1950s.[52]

The result of the Army's perception of neglect and the Air Force's emphasis on nuclear armed aircraft was a gradual organizational effort on the part of the Army leadership to develop its own organic CAS assets. This process was incremental because close air support was clearly an Air Force mission. But the technological development of the helicopter, an aircraft ill suited for strategic or operational missions, greatly assisted this shift. The helicopter muddied the waters around the boundaries between Army and Air Force tactical aviation.[53]

A series of interservice accords, starting with the 1949 Bradley-Vandenberg Agreement, sought to more exactly define those boundaries. The initial agreements focused on missions and weight ceilings on specific aircraft. Gradually, as the Army sought increased weights for helicopters, the delineation shifted to types of craft. The 1966 Johnson-McConnell Agreement finally defined the roles between the services based on the division between rotary and fixed wing.[54]

Although the Army's Aviation branch was not created until 1983, the branch considers its birthday to be 6 June 1942. On that day, the War Department created the Air-Observation-Post Program, which gave the field artillery its own organic light aircraft. These aircraft were the only aviation assets in the Army not under the control of the AAF and were intended, as the name indicated, to provide airplanes, pilots, and observers to support the fires of field artillery batteries. When fielded in 1943, the program placed an air observation section, consisting of two pilots, two planes, and supporting ground crews, in each divisional field artillery battalion and in the headquarters battery of the division artillery headquarters.[55]

Late in World War II, the War Department expanded the light aircraft program beyond the artillery to provide liaison and reconnaissance craft for combat divisions. The designation Army Ground Forces Light Aviation replaced the Air-Observation-Post Program. However, demobilization and the creation of the Air Force restricted the Army's organic aircraft to a small force of light fixed-wing aircraft with observation and liaison missions until a combination of the Korean War and the development of the helicopter resulted in a gradual expansion of Army aviation beyond light aircraft with supporting roles. This expansion, generally at the expense of the Air Force's perceived roles and missions, continued from 1950 until the Army received complete helicopter proponency under the terms of the 1966 Johnson-McConnell Agreement.[56]

The early development of rotary-wing aircraft was one of the many technological advances in the war years. The Army, however, did not possess any helicopters until 1946. The new technology looked promising, especially to short-range transportation for combat troops, and development advanced to the point that the Army planned to create a small experimental force even before war broke out in Korea in the summer of 1950. With the start of hostilities, this program received renewed emphasis, with the Army planning to create five companies of light transport helicopters within its Transportation Corps.[57]

In 1950, the document defining the delineation between Army and Air Force aircraft was the 1949 Joint Army and Air Force Adjustment Regulation (JAAFAR) 5-10-1, *Combat Joint Operations Etc.: Employment of Aircraft for Performance of Certain Missions*. The provisions of JAAFAR 5-10-1 allowed the Army to possess two types of aircraft: light fixed-wing planes of less than 2,500 pounds and rotary-wing aircraft with a maximum weight of 4,000 pounds. The regulation also clearly defined the missions of Army aircraft, which included aerial observation for field artillery fires, limited courier and reconnaissance missions, and emergency medical evacuation. The transportation mission of the projected new companies did not fall within the parameters of JAAFAR 5-10-1. Additionally, the newly developed helicopters planned for issue to these units, the H-19 Chickasaw and the H-21 Shawnee, exceeded the weight limit, the H-21 more than doubled it.[58]

Interservice disagreements delayed the deployment of the new units. Initially, the Air Force refused to waive the weight restrictions and even planned to create its own helicopter units to support the Army. However, the air service softened its stand because it did not want to procure helicopters at the expense of fixed-wing aircraft. A series of memorandums of agreement during the Korean War, particularly the 1952 Pace-Finletter Agreement, gradually expanded the permissible role of the Army in terms of helicopters. This role remained primarily that of tactical transportation, logistical resupply, and medical evacuation. Helicopters medically evacuated more than 21,000 soldiers during the war.[59]

Following the Korean War, Army leadership, research and development specialists, and aviators continued the technological and conceptual development of Army aviation. Post-Korean War Army helicopter theorists envisioned the mass tactical movement of troops by rotary-wing aircraft. The usefulness of the helicopter's ability to operate vertically on the battlefield was too good to pass up. Similar to the experience of early Air Corps enthusiasts, however, contemporary technology did not initially live up to these concepts. Helicopters were too underpowered to be useful for tactical troop movements until the Bell Helicopter Corporation applied a gas turbine engine to a helicopter prototype in 1955. The resulting craft, the UH-1 Iroquois, more commonly known as the Huey, began fielding in 1958 and, although initially envisioned as a utility craft, became the primary tactical assault helicopter in the Army through the Vietnam period.[60]

Two natural and intertwined extensions to the fielding of tactical transportation helicopters were the creation of armed helicopters to escort

and guard the troop-carrying aircraft and the application of the helicopter to a more extensive reconnaissance role to support heliborne troops. As early as 1942, the Army had tested the arming of helicopters, but it wasn't until after the Korean War that rotary-wing technology had advanced enough to put weapons on helicopters.[61]

Major General James M. Gavin, one of the premier World War II American paratroop commanders, opened the debate with an article in *Armor* magazine in 1954 that advocated creating large numbers of light helicopter and fixed-wing units to conduct the traditional cavalry missions of reconnaissance, screening, and counterattack. Gavin's influential treatise originated the concept of the helicopter as air cavalry, an expansion of the armed helicopter idea that ultimately resulted in the attack helicopter and the maneuver aviation brigade. To put teeth to his ideas, Gavin, as the Army's chief of operations, directed the field forces to shift their focus from developing the role of helicopter resupply to more tactical applications of rotary-wing aircraft.[62]

Not long after Gavin's article appeared, the Army began experimenting with armed helicopters and light fixed-wing airplanes. In 1955, the Army Aviation School, recently transferred to Fort Rucker, Alabama, from its original home with the Field Artillery School at Fort Sill, Oklahoma, conducted a series of tests. At the conclusion of the testing, the Continental Army Command (CONARC) concluded that light armed aircraft, both rotary- and fixed-wing, were not feasible with the then-available aircraft. However, the Aviation School continued experimentation in the late 1950s, with the mounting of rockets and SS-10 antitank guided missiles (ATGMs) onto helicopters. At the same time, the Army formally directed the Ordnance branch to develop means to mount machineguns onto transport helicopters. This period of experimentation culminated in the official adoption in November 1960 of special kits to provide the H-13 Sioux and UH-1 helicopters with machineguns and SS-11s.[63]

Concurrent with ordnance-based testing, Gavin-inspired concepts of air cavalry and airmobility began appearing in Army aviation, intelligence, and armor circles under the umbrella term "sky cavalry." A leader in this trend was Major General Hamilton Howze. In 1955, Howze, a World War II tank unit commander, became the senior aviation officer on the Department of the Army staff in the Pentagon. As such, in October 1957, he prepared a briefing and supporting memorandum that, for the first time, produced the concept of an air cavalry brigade. A concept called the Armair Brigade, created at the Aviation School, inspired Howze.[64]

The Armair Brigade was a conceptual design for the conversion of preexisting units to a combined arms brigade built around an infantry battle group (four rifle companies), a field artillery rocket battery, and various helicopter units (figure 21). The aviation elements included an assault component called the reconnaissance attack company, which contained H-34 Choctaw and H-21 Shawnee light transport helicopters and a battalion of H-37 Mojave medium cargo helicopters. The H-34s and H-21s could each carry an infantry squad and were armed with aerial rockets and machineguns.[65]

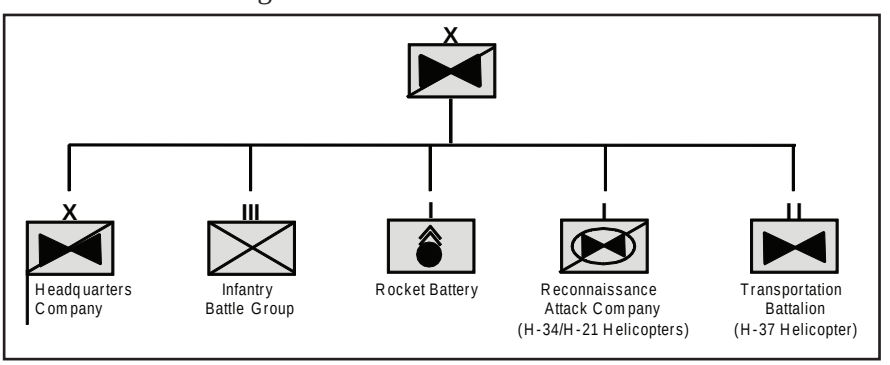


Figure 21. Armair brigade (notional), 1957.

For such a brigade, Howze proposed a theoretical scenario where the unit defended a section of Germany against much larger Soviet forces. Howze saw the brigade as primarily a reconnaissance organization. In this defensive scenario, he envisioned the brigade as being reinforced with artillery and engineers and supported by Air Force fighter-bombers. Howze also visualized the employment of not yet fielded helicopters with antitank weaponry to play a direct-fire role in fighting the Soviets. He stressed the use of the helicopter's mobility and three-dimensional aspect to conduct rapid tactical movements combining reconnaissance, the directed fire of armed helicopters, and the placement and extraction of ground troops at important locations (called airmobility) in a force capable of maneuvering against larger enemy ground forces.[66]

Howze was quick to point out later that most of his 1957 concepts were still purely conjectural. However, a combination of experimentation at Fort Rucker, Alabama, Fort Benning, Georgia, and Fort Bragg, North Carolina, and the fielding of new and better equipment, such as the UH-1 Huey and the CH-47 Chinook medium cargo helicopter, brought these ideas closer to reality by the end of the decade.[67]

When the Kennedy administration took office in 1961, its adoption of a flexible response policy to Cold War strategy reinvigorated the Army

in general and Army aviation in particular. With concepts such as those espoused by Howze, the development of the proper equipment became increasingly important, especially after designs for new light observation and attack helicopters failed to meet requirements. Even before the new administration took office, the Army had convened in 1960 two boards headed by Lieutenant General Gordon B. Rogers to look at aircraft requirements for the next decade and to develop training plans for the new equipment.[68]

When new Secretary of Defense Robert McNamara received copies of the findings of the two Rogers Boards with recommendations attached, he directed the Army to conduct a more comprehensive and more imaginative reexamination of Army aviation organization, doctrine, and equipment. In response, Secretary of the Army Elvis Stahr directed the establishment of the Army Tactical Mobility Requirements Board, commonly referred to as the Howze Board. Howze, by then a lieutenant general commanding the XVIII Airborne Corps, was appointed president of the board.[69] The Howze Board, consisting of 14 generals, 5 colonels, and 6 civilian experts, met from April through August 1962 and extensively examined Army aviation organizations, doctrine, and equipment using the assets of the 82d Airborne Division. The examination consisted of a combination of field tests and computer-based war gaming. The board made a series of recommendations for creating new aviation units as large as a division and as small as a company. The most significant recommendations were the proposed creation of five air assault divisions and three air cavalry combat brigades. Howze recognized that many of his board's recommendations were in violation of then-current agreements on roles and missions vis-à-vis the Air Force. But the general believed that the emerging technological and doctrinal advances necessitated a revision of these agreements.[70]

The air assault division was an infantry division that contained a large, organic aviation element (459 aircraft compared to about 100 in the infantry division) and a reduced ground transportation component (1,000 ground vehicles as opposed to 3,452 in the infantry division). All major elements of the division were light enough for helicopters to carry. To replace the heavier artillery found in the infantry division were 24 OV-1 Mohawk airplanes and 36 UH-1 Huey helicopters, both armed with 2.75-inch rockets. The use of the Mohawk as organic close air support for the division was one of the most controversial recommendations, as it reignited interservice conflict over roles and missions. The Army had been allowed to develop the Mohawk as a reconnaissance aircraft as an exception to the weight restrictions on Army aircraft. The inclusion of 80

AC-1 Caribous, a small transport airplane also approved for Army use by waiver, in a proposed transportation brigade designed to support the air assault division also caused conflict with the Air Force.[71]

Air Force leadership reacted negatively to the Howze Board and established its own panel, the Tactical Air Support Evaluation Board, under General Gabriel Disosway. The Disosway Board disputed many of the Howze Board findings and directly expressed the belief that the Army was using the helicopter as a means of gaining control of long-established Air Force missions. However, Disosway and his colleagues recognized that the Army had reasons for being dissatisfied with current CAS arrangements and recommended the creation of more USAF tactical fighter wings and an acceleration in the development program for the F-4C Phantom jet. Disosway recommended that future airmobility studies be a joint Army-Air Force effort and that Army procurement of the fixed-wing Caribous and Mohawks be halted immediately.[72]

Slightly less controversial, but more pertinent for the subject of this study, was the Howze Board's recommendation that the Army create air cavalry combat brigades (ACCBs). The ACCB was an all-helicopter unit built around a new type of aircraft not yet fielded, the attack helicopter (figure 22). The Howze Board projected the fielding of attack helicopters that could be equipped with either antitank or antipersonnel armament in the form of ATGMs and rockets. The brigade's main orientation was to place aerial fires on enemy forces, but its utility and observation helicopters gave it the ability to conduct reconnaissance, security, and limited infantry operations as well.[73]

Although the ACCB was not fielded because of a lack of funds and the emphasis on Vietnam, Secretary McNamara overrode Air Force objections and allowed the Army to test the Howze Board's air assault division structure. For this mission, the Army created the 11th Air Assault Division (Test) at Fort Benning in February 1963. From that point until mid-1965, the partially formed division tested the Howze Board's airmobile concept. Airmobility primarily focused on the tactical movement of infantry elements around the battlefield using helicopters. The test division contained an aviation group that included two light troop-carrying or assault Huey battalions and a medium CH-47 Chinook cargo battalion. The test division originally also contained an aerial surveillance and escort battalion equipped with armed Mohawk planes. This was an extension of the Howze Board's concept for employing the Mohawk.[74]

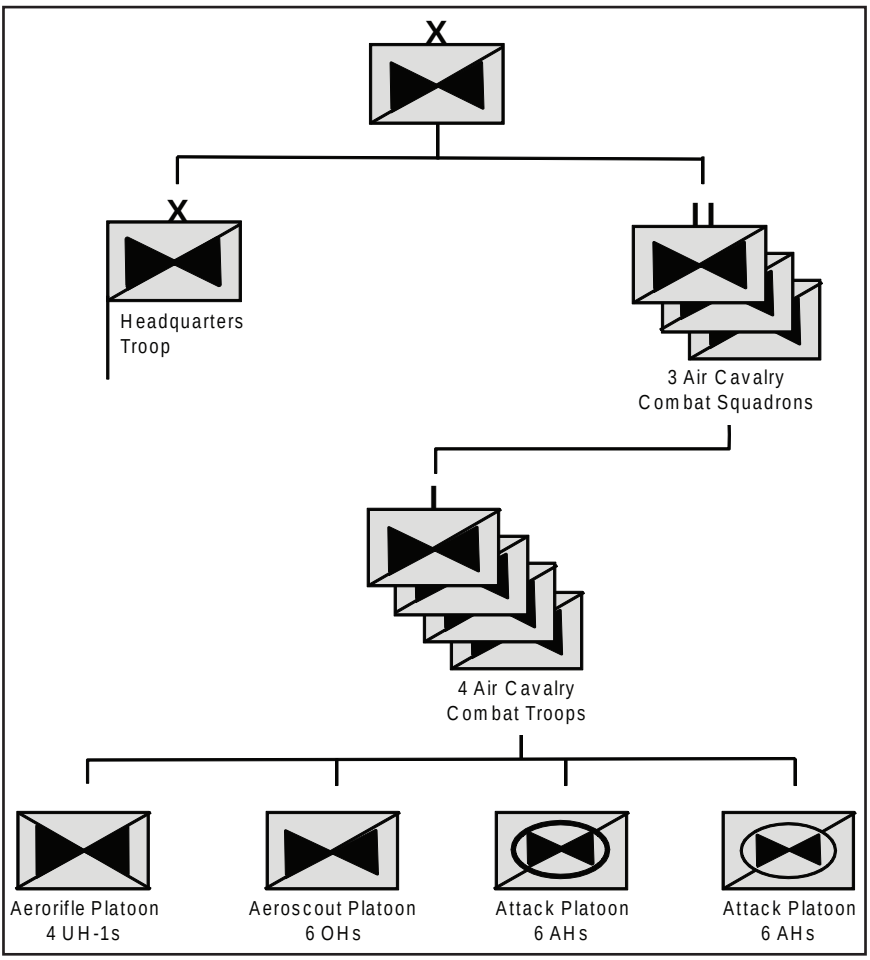


Figure 22. Howze Board Air Cavalry Combat Brigade, 1962.

The Air Force conducted its own airmobility tests concurrent with the 11th Air Assault Division tests. The Joint Chiefs canceled the Air Force tests in early 1965, effectively adopting the Army's concept. However, due to Air Force complaints, the battalion was scrapped from the final division design and replaced with rocket-firing helicopters. The DIVARTY contained such a battalion, referred to as "aerial artillery," while the two light assault battalions contained an aerial weapons company each. The Air Force was willing to grudgingly accept Army employment of large numbers of helicopters, even armed ones. But the service drew the line at fixed-wing aircraft. In June 1965, Secretary McNamara brokered a deal with the Secretary of the Air Force that removed the armed Mohawk from

the air assault division. This decision helped blunt Air Force animosity toward the fielding of the new organization.[75]

However, the dispute now shifted to the Army's desire to use its own Caribou aircraft for airlift within a theater. Army Chief of Staff General Harold K. Johnson was willing to sacrifice the Caribou rather than risk continued Air Force animosity concerning the Army use of helicopters. Possibly fearing Congressional and Department of Defense (DOD) investigations into the issue during the height of the US deployment to Vietnam, Air Force Chief of Staff John McConnell worked out a revised roles and missions agreement with Johnson in April 1966. Under the provisions of the Johnson-McConnell Agreement, the Army, for the most part, lost its larger fixed-wing aircraft and could not turn those remaining into gunships but received complete freedom to develop and deploy its fleet of rotary-wing craft.[76]

By the end of 1964, the Army considered the testing of the 11th Air Assault Division a success. In March 1965, the Army staff decided to add the division as a permanent organization. Shortly thereafter, with US involvement in Vietnam escalating, the decision was made to send the new division to Vietnam. To fill out the division, it was merged with the assets of an infantry division at Fort Benning, and the combined organization was redesignated as the 1st Cavalry Division (Airmobile). As such, the division deployed to Vietnam and served there for more than 5 years. In 1968, a second division, the 101st, was converted to airmobile (the new term, as of 1965, for air assault) status in Vietnam.[77]

Starting in 1962 and concurrent with the Howze Board, the Army began adopting a new divisional organization, known as ROAD (Reorganization Objective Army Division). The former structure, the Pentomic Division, contained a single aviation company. The new design contained two aviation organizations, a divisional aviation battalion and an air cavalry troop in the division's armored cavalry squadron.

An aviation company had been part of the Pentomic Division since 1959. The company provided aviation support to the division, primarily observation planes and helicopters. The company contained 19 fixed-wing aircraft and 27 helicopters. The ROAD battalion expanded the company and greatly increased the role of the helicopter. The new organization contained only four OV-1 Mohawk fixed-wing light observation aircraft but 22 light observation and 26 Huey utility helicopters. In addition to providing helicopters for command and control and aerial observation, the battalion also had enough Hueys to transport an infantry company at

one time. While the Hueys mounted machineguns, the battalion's main purpose was transportation not offensive combat.[78]

The air cavalry troop in the divisional armored cavalry squadron was a new organization with a different purpose from the aviation battalion. The troop had been under development for several years. In 1959, based on reports of the successful French use of armed helicopters in Algeria, the Army began its own tests. A year later, the Aerial Reconnaissance and Security Troop (ARST) Program formalized this experimentation. As part of this program, the Army conducted tests with French-made SS-11 ATGMs mounted on UH-1s. Other unit exercises simulated the use of SS-11 Hueys in an antitank role. With support from the Howze Board, when ROAD was adopted, the ARST became the fourth troop in the divisional reconnaissance squadron.[79]

The air cavalry troop combined observation helicopters, infantry, and rocket-firing helicopters in one organization. The troop consisted of two combat elements: an aeroscout platoon and an aerorifle platoon (figure 23). The aeroscout platoon had two light sections, each equipped with four OH-6A Cayuse light observation helicopters and a heavy section flying four UH-1B Huey utility helicopters. The OH-6A was later replaced with the OH-58 Kiowa. The aerorifle platoon contained four UH-1D troop carrier helicopters in its headquarters to carry its four infantry squads. The platoon also had a weapons section that deployed four UH-1B Hueys armed with 2.75-inch rocket launchers. This was the first nonexperimental use of armed helicopters in the Army. However, the service originally envisioned the armed Hueys only in a defensive role—escorting troop-carrying craft and providing fire support over landing zones (LZs). During the Vietnam period, the weapons section was later reequipped with the AH-1G Cobra attack helicopter and expanded to platoon size. The three elements of the troop were known colloquially as the white (aeroscout), blue (aerorifle), and red (aeroweapons) teams.[80]

The airmobile division contained an air cavalry squadron that consisted of three air cavalry troops and one ground troop. The air cavalry troops each contained an aeroscout platoon, an aerorifle platoon, and an aeroweapons platoon that were similarly equipped to the equivalent units in the air cavalry troop in the armored cavalry squadron. The ground troop consisted of two jeep scout platoons equipped with machineguns and 106-mm rifles. While in Vietnam, one of the platoons replaced its jeeps with amphibious armored cars.[81]

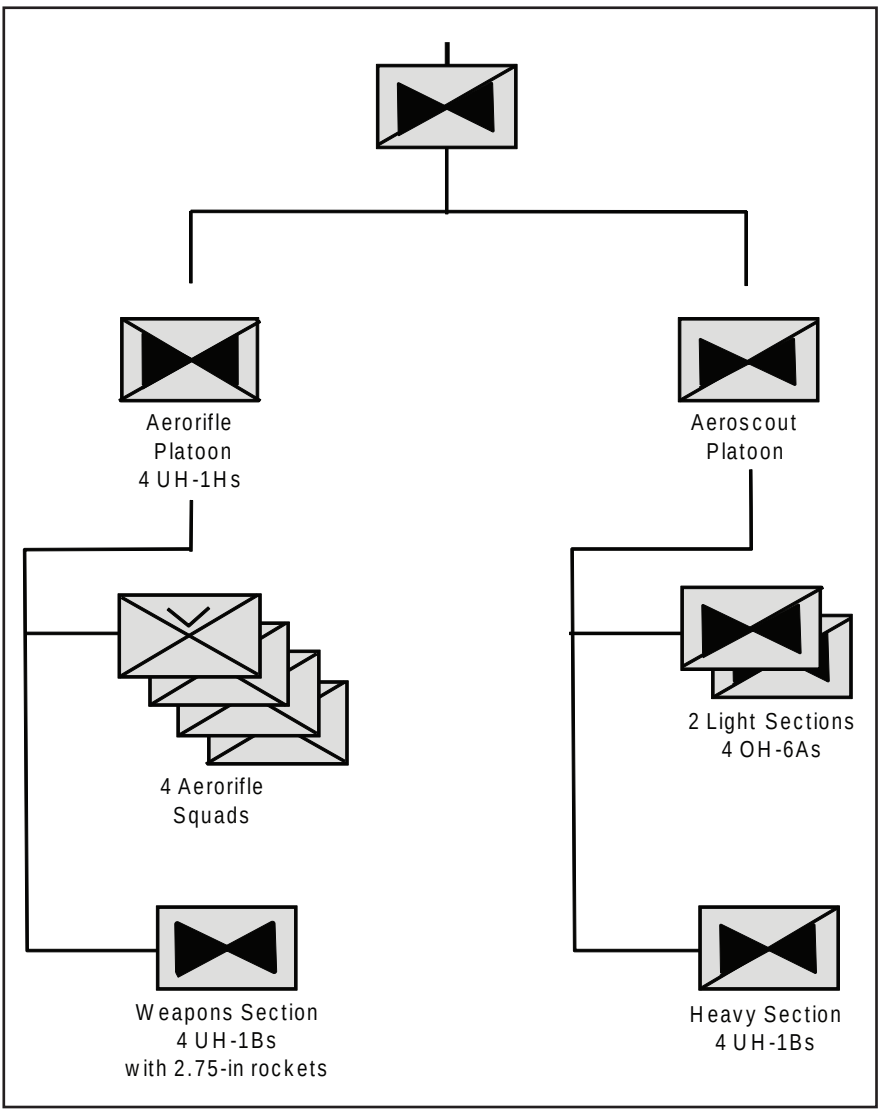
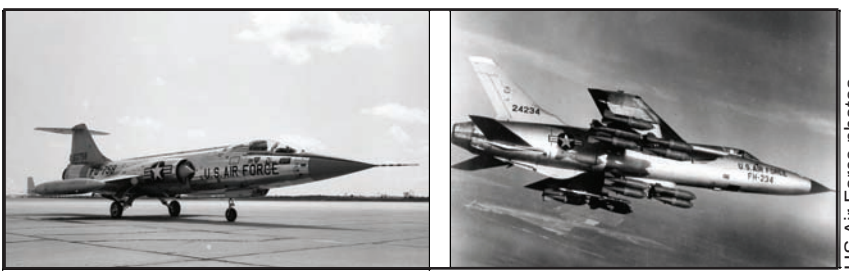


Figure 23. Division air cavalry troop, 1962.

Vietnam

While the Army developed helicopters, with grudging acceptance from the Air Force, close air support became secondary to the nuclear mission. In fact, even the revived TAC downplayed ground support in the mid-1950s, essentially becoming an accessory to SAC's massive retaliation forces. All new TAC aircraft had a nuclear capability. Because of this emphasis, TAC depended on the Navy for the development of conventional munitions.[82]

Despite these developments, by the late 1950s, TAC was beginning a revival of CAS awareness that would pay dividends in the next decade. In 1957, TAC and CONARC drew up an agreement on a modified air-ground system that, with a few minor modifications, was used throughout the Vietnam War.[83]



US Air Force photos

Figure 24. F-104 Starfighter (left) and F-105 Thunderchief (right).

In addition, the Air Force began fielding a new generation of aircraft that could be used in CAS operations. These included the F-100 Super Sabre, a supersonic fighter-bomber fielded in 1955. Better fighter-bombers followed the Super Sabre, which included the F-104 Starfighter and the F-105 Thunderchief, both deployed starting in 1958. The F-104 was the first USAF jet capable of mach 2 speed and had a combination of a 20-mm cannon, two missiles, and a bomb load of 2,000 pounds. The F-105 also had a 20-mm cannon and could carry 4,000 pounds of bombs for CAS missions.[84]

In the late 1950s, new and improved aerial munitions also were being developed, which began to be fielded in the early 1960s. These included cluster bombs, pod-mounted 20-mm guns that could be attached to fighter-bombers, and point-target rocket launchers.

With these jets and projected improved munitions in the inventory, TAC began reemphasizing nonnuclear missions in 1959.[85]

TAC's reinvigoration continued when the Kennedy administration instituted its policy of flexible response, which stressed conventional capabilities as much as the nuclear one. TAC began conducting formal joint peacetime training with the Army in 1962 and, in 1963, began permanently posting FACs and air liaison officers with Army units. On the eve of Vietnam, the USAF deployed 15,218 tactical fighter-bombers in 21 wings.[86]

Figure 25. The M102 105-mm howitzer.

The vicissitudes of the new look-flexible response had little impact on conventional field artillery, aside from organizational shifts in 1957 and 1963. In the latter ROAD reorganization, brigades replaced the former battle groups and earlier regiments as the element supported by the DS field artillery battalion. Infantry divisions still fielded three 105-mm DS battalions and a 155-mm general support (GS) battalion. The field artillery received a new 105-mm howitzer in 1966, the M102, which replaced the World War II-era M101. Under ROAD, armored and mechanized divisions contained three 155-mm self-propelled DS battalions equipped with the new M109 and an 8-inch (203-mm) self-propelled GS battalion. The Army organized nondivisional artillery under artillery groups and corps artillery headquarters.[87]

The fire support system was similar to that used in Korea, with several key changes. In terminology, the term "fire support officer" (FSO) replaced ALNO. The change was not purely cosmetic. The FSO was now considered to be the fire support coordinator (FSCOORD) for the command. The FSCOORD managed all the fire support available to the organization, including field artillery, attack helicopters, close air support, naval gunfire, and at the battalion level, usually, the heavy mortar platoon. At levels higher than battalion, the artillery unit commander was actually

the FSCOORD, but this responsibility was normally delegated to the FSO at the supported unit.[88]

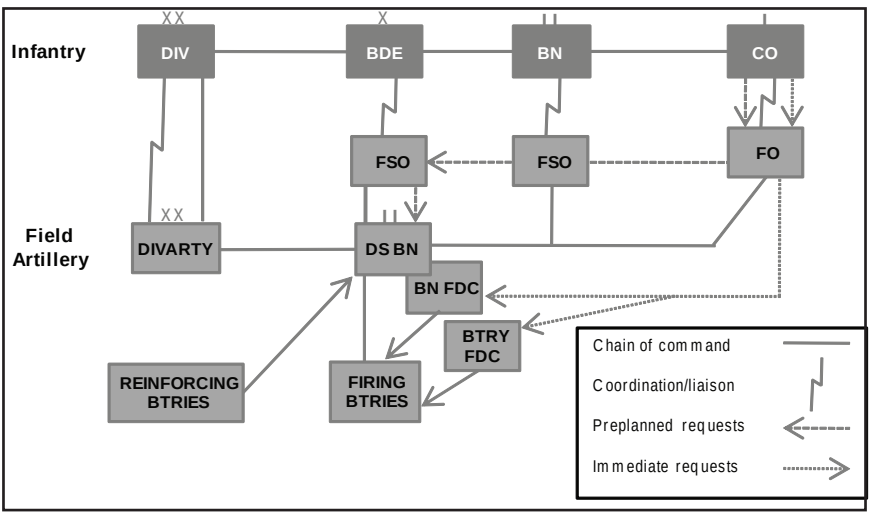


Figure 26. The Army Fire Support System, 1965.

Counterinsurgency in Vietnam would prove a challenge for both field artillery and close air support. The supported units were often dispersed far wider than they would have been in conventional operations. There was no rear area. These two factors caused the artillery to adopt the firebase concept. To protect scattered artillery units, usually of battery size, units established semipermanent firebases (or fire support bases (FSBs)), usually at the beginning of an operation.

FSBs typically contained one or two batteries (usually a DS and a GS battery) and a defensive force consisting of an infantry company on rotation from the supported battalion. With dispersion in Vietnam, artillery battalions, usually otherwise in support of a whole brigade, often broke down their batteries and dedicated their support to specific infantry battalions. Likewise, battery FDCs, usually answerable to the battalion FDC, often acted independently. Figure 27 provides an example of how artillery deployed into firebases for an operation.[89]

Despite their defenses, firebases often became prime targets for the enemy. The North Vietnamese and Viet Cong frequently tried to infiltrate firebases in swift night raids called sapper attacks. The optimistic objective of a sapper attack was to overrun the FSB. Few sapper attacks were successful, but the ones that were usually resulted in the destruction of several cannons and the killing or wounding of gun crews.[90]

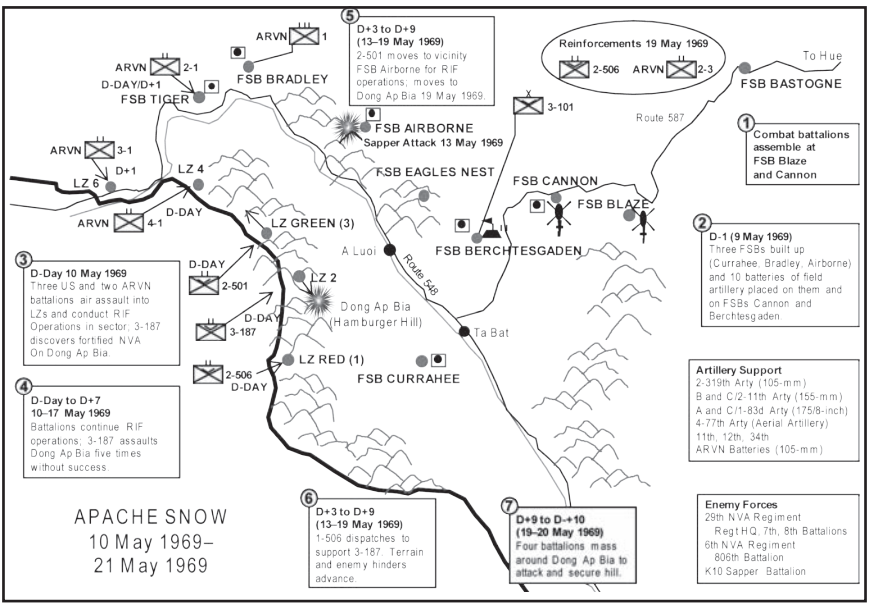


Figure 27. FSBs in the A Shau Valley, 1969.

Unlike in Korea, in Vietnam, the Army deployed extensive artillery assets. In 1969, the Army deployed 61 artillery battalions to support 59 infantry battalions, a ratio of roughly one field artillery battalion for every infantry battalion. Additionally, most DS battalions created a fourth battery in response to the large areas of operations in which most brigades operated. Facilitating the use of the fires of these units, the FOs and FSOs received specialized training at the Field Artillery School. What had been a rotating duty in World War II had now evolved into one of the most important branch duties. In the decade after the war, the FO/FSO team would undergo more changes.[91]

Air Force close air support was much better prepared for operations in Vietnam than it had been for Korea. However, Vietnam presented challenges in style of warfare and terrain. The enemy was initially fighting an insurgency and, because of the limited nature of the war, often had readily available sanctuaries into which to flee. The jungle environment resembled that of the Pacific theater in World War II, but there the enemy would not stand and fight to the last life.

Although one scholar contends there was extensive interservice rivalry in Vietnam, the strain between Army and Air Force commanders seen in Korea was less so in Vietnam. There was no Vietnam version of Almond. The unique circumstances of the war in Southeast Asia resolved most of these issues. These are discussed in terms of the CAS themes from Korea.[92]

The prioritization of air missions and air mission tasking was not a major issue of contention in Vietnam as both the Air Force and Army had set up systems to streamline the process. Additionally, the dispersion of deployment and operations blurred the distinction between interdiction and close air support. The system for the tasking of air missions in Vietnam developed from the 1957 agreement between TAC and CONARC. Both services set up the air-ground system in the early years before US ground troops were committed to the war and expanded and adjusted the system thereafter. In May 1966, the Military Assistance Command, Vietnam (MACV), combined the Air Force and Army systems under the Joint Air-Ground Operations System (JAGOS) (figure 28). At each echelon from battalion to theater command, the Army and Air Force had parallel elements designed to control and coordinate air support.[93]

Control of air assets was one of the Korean War issues. The Air Force considered the centralization of airpower to be essential. But under JAGOS, the Air Force retained centralized control while allowing for decentralized execution. The mission of JAGOS was the tasking of air support. Preplanned requests could be submitted from any Army echelon at least 24 hours before their planned execution. Such requests passed through the Army fire support elements (fire support coordination center at battalion and brigade levels—essentially the S3 air and FSO), the division tactical operations center (DTOC), and corps tactical operations center (CTOC) to the Tactical Air Support Element (TASE) at MACV, which worked in tandem with the Air Force's Tactical Air Control Center. TACC allocated available sorties to ground units and passed on approved preplanned CAS mission requests to the TACC for execution.[94]

After the problems with immediate CAS requests in Korea, the services developed a highly effective system for use in Vietnam. Immediate requests went directly from units in the field to the Air Force agency at the Direct Air Support Center (DASC), an element found in each Vietnamese corps district. DASC provided decentralized execution of immediate air missions. The DASC coordinated with the CTOC, the parallel Army agency, and if the Army agreed with the mission, ordered its execution.[95]

The Air Force provided TACPs down to battalion level in Vietnam and extensively used airborne FACs flying in a series of observation planes, which culminated in the fielding of the OV-10 Bronco in 1968. The OV-10 could loiter for up to 3 hours while directing airstrikes. The Bronco remained in service until the early 1990s.[96]

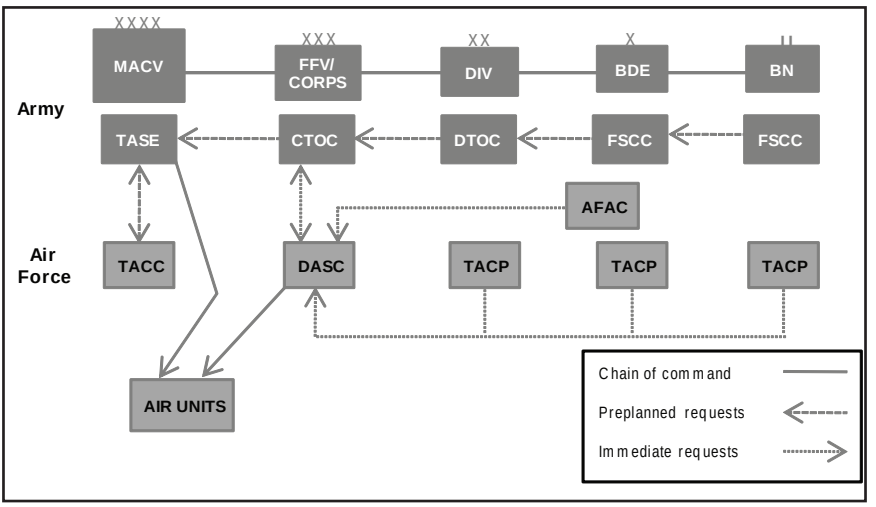


Figure 28. The Joint Air-Ground Operations System in Vietnam.

http://www.dodmedia.osd.mil/Assets/1985/Air_Force/DF-ST-85-05744.JPEG

Figure 29. O-V-10 Bronco.

As it was in Korea, the types of aircraft for use in CAS missions in Vietnam were a major interservice issue. Originally, the USAF deployed the A-1 Skyraider, a Navy CAS plane of late World War II vintage. As Vietnam received a higher priority, jets replaced propeller planes. By 1967, another Navy design, the F-4 Phantom, became the standard Air Force CAS fighter-bomber in Southeast Asia. At the end of the war, the A-7D Corsair was fielded, yet another Navy plane adopted for USAF use. Aircraft originally designed for carrier landings and takeoffs proved useful

in the CAS role because they could land at a variety of airfields and were not too sophisticated in design that many of the chrome features would not be needed for close air support.[97]

Figure 30. A-1 Skyraiders (left) and F-4 Phantom (right).

The USAF also began a tradition of converting transport aircraft into CAS roles. The first of these was the AC-47. This craft, nicknamed "Spooky" or "Puff the Magic Dragon," was a C-47 World War II-era transport plane converted with the placement of three 7.62-mm miniguns in the cargo compartment of the plane. Using an electronic targeting system, the pilot fired the miniguns from the cockpit. Spooky was phased out by 1969 and replaced with the AC-119, a similar design mounting four miniguns and two 20-mm Vulcan cannons. Concurrent with the introduction of the AC-119, the AC-130 Spectre gunship began deployment. The AC-130 was originally armed similar to the AC-119, but later variants included the mounting of a M102 howitzer in front of the rear cargo ramp. The AC-130 has remained in service to this day.[98]

SAC executed operations in Vietnam using B-52 Stratofortress strategic bombers under the banner of Arc Light. A single Arc Light aircraft could drop 84 500- and 750-pound bombs. More than half of the 67,000 Arc Light sorties took place in South Vietnam and required ground coordination. The overwhelming majority of Army generals polled considered the effects of B-52 strikes to be the best support received from the Air Force.[99]

Army Aviation in Vietnam and After

Both American and South Vietnamese troops used helicopters extensively for transportation and fire support. The first US helicopters deployed to Vietnam in 1962 to support the forces of the Army of the Republic of Vietnam (ARVN). Most helicopter units remained theater assets, assigned to the 1st Aviation Brigade, which was established in 1966.

The brigade administratively controlled all aviation assets not assigned to divisions and, at one time or another, had 7 aviation group headquarters, 20 aviation battalions, and 4 air cavalry squadrons under its command. For operations, the aviation groups, with varying subordinate battalions, were attached to divisions or higher headquarters units.[100]

During the Vietnam War, Army commanders used armed helicopters primarily to escort helicopter assaults and provide fire support during such aerial movements. The Army activated its first armed helicopter unit in July 1962. Many additional units followed. Based on the findings of the Howze Board, the Army began developing an attack helicopter in 1963. The result of this research and development effort was to field the AH-56 Cheyenne. However, on an interim basis, the Army used UH-1Ds and then a Huey derivative, the AH-1 Cobra, which began fielding in Vietnam in 1967. The prototype for the Cheyenne also came out in 1967. The AH-56 was virtually a flying tank, equipped with various combinations of a 30-mm automatic gun turret, 40-mm grenade launcher, a turreted 7.62-mm Gatling gun, the TOW (tube-fired, optically-tracked, wire-guided) ATGM, and 2.75-inch rocket launchers. However, after production delays and cost overruns, the Army postponed the Cheyenne project in 1969, and Congress canceled it all together in 1972 primarily because the Air Force began developing the A-10 CAS aircraft. The Cobra remained the standard Army attack helicopter for more than another decade.[101]

The Air Force's acceptance of the Army's lead in helicopter development was at least partially in response to criticism of the air service's CAS effort in Vietnam. Operations in Southeast Asia highlighted the differences between the Army and Air Force in relation to close air support, particularly in terms of aircraft design. In this dispute, the Army received support from Kennedy administration Defense Secretary Robert McNamara and the Navy leadership, both of whom favored the development of a specialized CAS aircraft rather than the multirole design favored by the Air Force.[102]

Interservice maneuvering continued during the 1960s. The ultimate result was the adoption of the A-7D Corsair and F-4 Phantom, both originally Navy designs, for specialized use in the CAS role in Vietnam. The Air Force, however, considered the A-7D and F-4 to be only an interim solution. The Army's Cheyenne program threatened the Air Force leadership. Chief of Staff McConnell felt the pressure, believing that, if the Army fielded the Cheyenne, the Air Force would lose not only aircraft funding but, possibly, the CAS mission altogether.[103]

Therefore, breaking its postwar tradition of developing multifunctional combat aircraft capable of conducting strategic as well as tactical missions as an organizational imperative, the Air Force began developing an aircraft specially designed for the CAS mission in 1967. This airplane, fielding beginning in 1976, became the A-10 Thunderbolt II. McConnell's tactics were effective: the fielding of the A-10 effectively delayed the Army's development of an advanced attack helicopter for a decade.[104]

Before deployment to Vietnam, there were fears of the helicopter's vulnerability to ground fire. Operations in Southeast Asia seemed to disprove such fears. To quantify such impressions, in 1969, the Army command in Vietnam measured the loss rates and relative combat effectiveness of the armed helicopter. The results of the study indicated that one armed helicopter was lost for every 5,700 sorties. Nevertheless, that 199 such aircraft were lost in the 14-month period between 1 February 1968 and 30 April 1969 that was studied showed the intensity of operations at the height of American deployment.[105]

The two US airmobile divisions in Vietnam contained an aerial rocket artillery (ARA) battalion each. Although equipped similar to the early model armed helicopter escorts with 2.75-inch rockets, the Army treated ARA helicopters as if they were artillery with a company-size ARA battery usually supporting each of the division's three combat brigades. ARA units communicated on the artillery radio network rather than on that of the supported unit. This sometimes resulted in fratricidal incidents, the most famous being during the Battle of Hamburger Hill in May 1969. After Vietnam, the attack helicopter organization supplanted both the armed helicopter and ARA models.[106]

In Vietnam, armed helicopters, sometimes also called helicopter gunships, and aerial rocket artillery, almost exclusively supported ground operations. After-action reports and later commentaries by former ground commanders always remarked on the remarkable responsiveness of Army aviation fire support. Helicopter fires averaged an arrival time of 12 minutes from request. Many senior Army officers thought that aviators accomplished this feat because helicopter unit commanders had all been ground soldiers first and, therefore, acquired a sense of urgency when it came to supporting the infantry.[107]

In April 1972, after almost all US units had redeployed from South Vietnam, the North Vietnamese conducted a large attack, which included sizable tank forces, against the city of An Loc. ARVN forces and US airpower repulsed the Communist offensive. In the operation, a task force

of Army AH-1G Cobra helicopters supported the defense with effective attacks on North Vietnamese armor. Army aviation observers later considered this the first effective use of Cobras in the attack helicopter mode.[108]

The ACCB concept reemerged in 1970 in Vietnam in an ad hoc fashion. On 26 October 1970, the 1st Cavalry Division (Airmobile) received the attachment of an additional air cavalry squadron and aviation company. The division commander combined these assets with the division's own air cavalry squadron, the divisional aerial rocket battalion, and the division's long-range patrol infantry company to form the provisional 9th Air Cavalry Brigade (Combat). The brigade, with more than 120 AH-1s, represented the largest concentration of armed helicopters under one command during the Vietnam War. For most of its 7-month existence, the brigade did not operate as a unit. However, it did support several ARVN units in operations in Cambodia in February 1971. The brigade was disbanded as the 1st Cavalry Division and redeployed to the United States in April 1971.[109]

ACCB performance in Vietnam received mixed reviews. In retirement, Howze lamented its absence as a permanent unit. But the organization soon reappeared in the postwar experimental TRICAP Division organization. The TRICAP (for triple capability) Division was a tweaking of the ROAD structure where one division contained three different types of brigades: armored, airmobile, and air cavalry combat. When the 1st Cavalry Division returned from Vietnam to Fort Hood, Texas, in 1971, it assumed this mission. While the airmobile brigade contained three infantry battalions, a towed field artillery battalion, and the former division aviation battalion, the ACCB was composed of the former divisional air cavalry squadron and one newly created active and one projected attack helicopter battalion equipped with AH-1 Cobras. The TRICAP experiment lasted until 1974 when Army planners, concerned with a new emphasis on armored combat in Europe, converted the division into a standard armored division and transformed the ACCB into the separate 6th Cavalry Brigade (Air Combat). Figure 31 shows this brigade's organizational structure.[110]

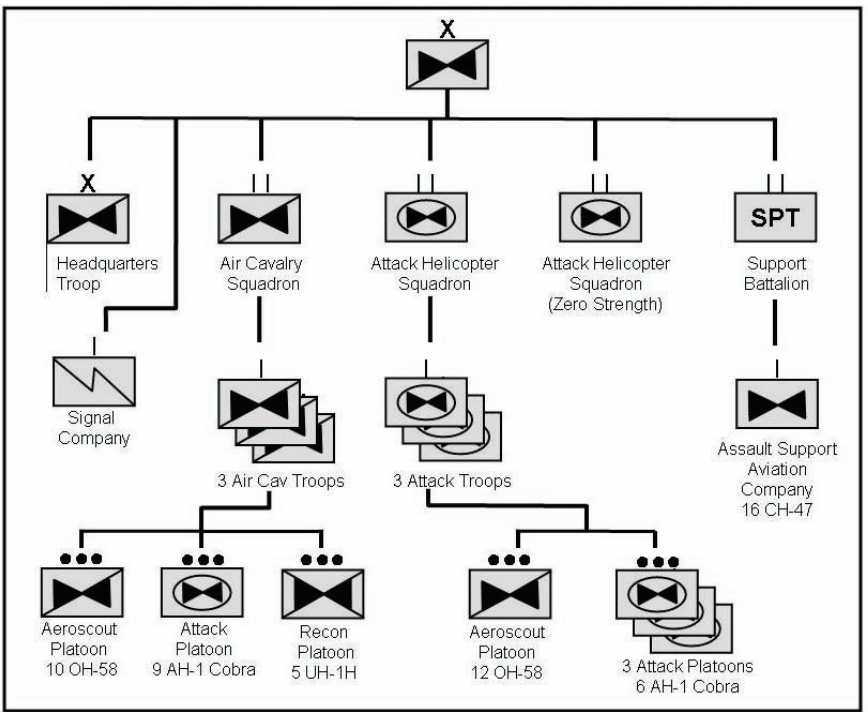


Figure 31. Air cavalry combat brigade, 1974.

The TRICAP Division was the Army's attempt to expand the air assault division concept to offensive operations—creating an attack aviation element within the divisional structure. Although the concept was scrapped, it was a precursor to the later inclusion of an aviation brigade into every division a decade later.

The ACCB contained 81 attack helicopters with 27 in the air cavalry squadron and 54 in the attack helicopter squadron. This made it a formidable aerial strike force, particularly when its Cobras mounted the TOW ATGM system. As organized, the ACCB differed from the Howze Board brigade (figure 22) in that the latter was almost exclusively an attack helicopter unit, containing 144 attack helicopters organized under attack helicopter platoon, troop, and squadron headquarters. The 6th ACCB contained only a single attack helicopter squadron with one-third of its attack craft in the air cavalry squadron.[111]

Despite organizational differences, the distinction between air cavalry and attack helicopter units became blurred in the ACCB, as both types of units were given cavalry designations when the brigade was still part of the 1st Cavalry Division. In 1975, the first commander of the 6th ACCB

still discerned a distinction between air cavalry and attack helicopters. Colonel Charles Canedy saw it as a matter of organization: "Any aviation organization with attack helicopters can attack. The air cavalry troop can attack with its nine AH-1s. It cannot, however, sustain a sizeable attack. The attack troop, on the other hand, with its three platoons of five operational AH-1s each, can sustain a platoon-sized attack indefinitely."[112]

However, in later years, particularly after Aviation became a separate Army branch in 1983, battalion-size units equipped primarily with attack helicopters could be designated either as attack helicopter battalions or as air cavalry squadrons. Although not shown in unit designations, the Army drew a distinction between air cavalry troops and squadrons that were reconnaissance organizations and those that were really attack helicopter units. The latter fell under a table of organization and equipment (TOE) for an "air cavalry attack" unit. The only difference between the mission statement of an air cavalry attack unit and an attack helicopter organization was the addition of two traditional cavalry missions: economy-of-force and security operations.[113]

The Key West Agreement had broadly defined airpower, including a bundle of missions to support ground forces. The Johnson-McConnell Agreement of 1966 gave the Army control over such support missions conducted at the tactical level by rotary-wing aircraft. While airpower had always been a joint function, with the Navy and Marine Corps fielding their own aviation components in addition to the Air Force's strategic, tactical, and support forces, the 1966 agreement formalized a role for the Army in aviation at the tactical level as well.[114]

Summary

The period from 1946 to 1975 established and reestablished the roles and missions between the Air Force and Army in terms of close air support. At several times during this period, close air support became a decidedly secondary mission in favor of strategic bombing and nuclear forces. In the first case, war resolved this issue; in the second, the accession of a new president with a different vision revitalized close air support. Despite some issues, Vietnam was a success in interservice cooperation. Part of this was the Army's ability to develop the attack helicopter. The foray into counterinsurgency also eliminated some of the major issues between the services.

Field artillery retained and refined its successful World War II system, which provided responsive and massed fires. The FDC and FO system continued to be tweaked. The role of the artillery liaison officer gradually

developed into that of the fire support officer who was responsible for coordinating not only artillery support but also other fires available to the supported unit.

After Vietnam, the United States turned its attention back to the Cold War where the threat of massed Soviet armor and artillery in Central Europe reinvigorated the need for joint combined arms in any projected future war. The introduction of the attack helicopter complicated the CAS debate. The development of precision munitions would revitalize airpower theory, both as an independent force on the battlefield and in conjunction with ground forces.

Notes

1. Thomas Alexander Hughes, *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II* (New York: Free Press, 1995), 308–309.

2. US Department of the Army, Field Manual 6-20, *Field Artillery Tactics and Techniques* (Washington, DC: Department of the Army, 1948), 68, 109, 114. New tables of organization and equipment (TOE) gave each firing battery in a direct support field artillery battalion three FO teams. The battalion headquarters battery (HHB) contained four ALNO positions. The HHB in each general support field artillery battalion contained two FO teams and one ALNO. Each tank company was issued an extra tank for the FO to fire in. The division artillery of the armored division was also standardized to match that of the infantry division (i.e., the division gained a 155-mm GS battalion), except the guns were all self-propelled. See Janice E. McKenney, *The Organizational History of Field Artillery, 1775–2003* (Washington, DC: US Army Center of Military History, 2007) 190–191.

3. McKenney, 196–197.

4. McKenney, 197, 200, 203.

5. McKenney, 201–203.

6. McKenney, 204–205.

7. McKenney, 198.

8. Ian Gooderson, *Air Power at the Battlefront: Allied Close Air Support in Europe 1943–45* (Portland, OR: Frank Cass, 1998), 167.

9. US War Department, Field Manual 31-35, *Air-Ground Operations* (Washington, DC: War Department, 1946), 30.

10. US War Department, Field Manual 31-35, *Air-Ground Operations*, John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946–1973* (Washington, DC: US Air Force History and Museums Program, 2003), 58–59.

11. Field Manual 31-35, *Air-Ground Operations*, 5, 12–13, 38.

12. Field Manual 31-35, *Air-Ground Operations*, 2, 63–65.

13. Field Manual 31-35, *Air-Ground Operations*, 7, 63–65; Schlight, 60.

14. Field Manual 31-35, *Air-Ground Operations*, 3, 7–8, 63.

15. Field Manual 31-35, *Air-Ground Operations*, 2–3, 66.

16. Schlight, 62–63.

17. Schlight, 62; Hughes, 311–312.

18. Hughes, 305, 311.

19. Hughes, 312.

20. Hughes, 304–306.

21. Schlight, 117–118.

22. Schlight, 120; Michael Lewis, *LtGen Ned Almond, USA: A Ground Commander's Conflicting View With Airmen Over CAS Doctrine and Employment* (Maxwell Air Force Base, AL: Air University Press, 1997), 35, 38.

23. Schlight, 133, 135; Lewis, 35–36.

24. Lewis, 57–58: Schlight, 164–165.

25. Schlight, 134.

26. Lewis, 34–35; Schlight, 123, 133.
27. Schlight, 134.
28. Schlight, 138.
29. Schlight, 139.
30. Schlight, 140.
31. Lewis, 58; Schlight, 145–147.
32. Schlight, 150–151. Technically, X Corps was a separate command from Eighth Army until 1951, allowing Almond to get direct access to the Fifth Air Force staff.
33. Schlight.
34. Schlight, 152–153.
35. Schlight, 143, 167; Lewis, 62.
36. Lewis, 64.
37. Schlight, 122; Lewis, 43–44.
38. Lewis, 44.
39. Schlight, 139.
40. Schlight, 160.
41. Lewis, 45.
42. Lewis, 66.
43. Lewis, 69–70.
44. Lewis, 71.
45. Lewis, 72.
46. Schlight, 179.
47. This graphic was adapted from a figure in the US Army Aviation Warfighting Center, *Aviation Warfighting Treatise* (Fort Rucker, AL: US Army Aviation Warfighting Center, 1993), 10.
48. Schlight, 93.
49. House Committee on Government Operations, *National Security Act of 1947* (Washington, DC: Government Printing Office, 1947), 14.
50. Robert F. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907–1960*, vol. I (Maxwell Air Force Base, AL: Air University Press, 1989), 198–199; Edgar F. Raines Jr. "Army-Air Force Cooperation: When There Was Common Ground in the Air," *Army* 45 (March 1995), 27–28.
51. Ian Horwood, *Interservice Rivalry and the Vietnam War* (Fort Leavenworth, KS: Combat Studies Institute Press, 2006), 16–20; Douglas N. Campbell, *The Warthog and the Close Air Support Debate* (Annapolis, MD: Naval Institute Press, 2003), 37.
52. Ibid.; Alain C. Enthoven and K. Wayne Smith, *How Much Is Enough? Shaping the Defense Program, 1961–1969* (New York: Harper and Row, 1971), 9.
53. The Air Force rightfully feared the Army was trying to take over the CAS mission. In his memoirs, recently retired Army Chief of Staff Matthew Ridgway devoted a whole chapter to his belief that the Air Force neglected support to the Army and that something had to be done to correct the situation. Ridgway culminated his comments with the statement that, if the Air Force continued to ignore the needs of the Army in close air support, the Army would have to

eventually develop its own CAS forces. See Matthew B. Ridgway, *Soldier: The Memoirs of Matthew B. Ridgway* (New York: Harper, 1956), 311–316.

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55. James W. Bradin, *From Hot Air to Hellfire: The History of Army Attack Aviation in World War II* (Novato, CA: Presidio, 1994), 61–62; Edgar F. Raines Jr., *Eyes of the Artillery: The Origins of Modern US Army Aviation* (Washington, DC: US Army Center of Military History, 2000), 78–80, 85, 129, 138, 141.

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66. Howze, "The Howze Board," Part 1, 13; Grayson, 4; Weinert, 181–182.

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69. Stockfisch, 39; Hamilton Howze, "The Howze Board," Part 2, *Army* 24 (March 1974), 21; Huber, 10.

70. Howze, "The Howze Board," Part 2, 21; Stockfisch, 20; Huber, 12; Horwood, 57.

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95. Schlight.
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98. Schlight, 316.
99. Schlight, 324–325.
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103. Campbell, 45, 58–61, 199.
104. Campbell, 65, 73, 110–112.
105. Bonin, 20. The Air Force loss rate during the same timeframe was 1 loss per every 3,000 sorties.
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Chapter 4

The Rise of Technology: US Army and Air Force Fire Support Since 1975

The period since 1975 has been a time of organizational and technological innovation for field artillery, Army aviation, and Air Force close air support. The late 1970s also ushered in technological advances in weaponry and communications that affected both artillery systems and close air support. Improved weapons platforms such as the Apache attack helicopter and laser designation targeting systems increased the effectiveness of fire support. In conjunction with materiel improvements, the US Army Training and Doctrine Command (TRADOC) revised doctrine to include Air Force close air support as an integral part of the AirLand Battle concept, while simultaneously fielding improved organizations, such as larger field artillery batteries and the fire support team (FIST), and creating divisional aviation brigades.

After Vietnam, the Armed Forces of the United States refocused on Central Europe where the Soviet Union had executed a large buildup of armored forces during the Vietnam era. In response to this expansion, the United States Army began an unprecedented peacetime expansion of field artillery units in West Germany that resulted in fielding more field artillery battalions than mechanized infantry battalions.

Field Artillery in the Late Cold War Period

While the FO concept had been used effectively since World War II, the fear of the renewed Soviet threat resulted in TRADOC tasking the Field Artillery School to analyze the current fire support system and present a series of recommendations. The Field Artillery School created the Close Support Study Group (CSSG) in July 1975. In November 1975, the CSSG made its recommendations, and the Army began implementing them in the following years with the transition being completed by 1978.[1]

The recommendations included creating FISTs in each maneuver battalion (tank and infantry) in the Army. The FIST would technically belong to the direct support field artillery battalion habitually associated with the maneuver battalion's brigade. In a later tweak, the divisional general support field artillery battalion provided additional FISTs for the divisional cavalry squadron and any extra maneuver battalions assigned to the division. Both the FIST and the FSOs at the battalion and brigade levels, while assigned to field artillery units, remained permanently with the supported units during peacetime and wartime.[2]

Before the development of the FIST, all fire support assets available to the maneuver company commander supplied separate FOs or coordinators. This included FOs from the field artillery direct support battalion, the company 81-mm mortar platoon, and the battalion 107-mm heavy mortar platoon, each equipped with jeeps even in mechanized units. Under the FIST concept, these FOs were consolidated into one team.

A field artillery lieutenant, who replaced the company FO, led the team. The team chief was equipped with his own vehicle. In mechanized units, this was an M113 armored personnel carrier. Later, this vehicle was upgraded into the fire support vehicle (FSV), originally an M113 equipped with a laser designator. The FSV was periodically upgraded with M2 Bradley infantry fighting vehicle and Stryker wheeled armored vehicle. The FSV was fully equipped with the latest communications equipment.[3]

The FIST chief was the fire support coordinator for the company. He was expected to do the fire planning for the unit and recommend the best way to attack a target. FIST chiefs were trained to call in close air support, but the Air Force usually reserved this mission for its FAC in its TACP. By the 1980s, each maneuver battalion received a TACP.[4]

A fire support noncommissioned officer (NCO) assisted the FIST chief. The rest of the team consisted of enlisted forward observers for each company platoon. Whereas in the past, enlisted FOs typically held the mortar military specialty (11C), under FIST, they were specifically trained under a new artillery specialty (13F).

The Field Artillery branch had begun automating fire direction when it introduced the field artillery digital automatic computer (FADAC) in 1959. A completely digitized system, the Tactical Fire Direction System (TACFIRE), took more than 20 years to develop. TACFIRE began fielding in 1982. It used VHF radio communications and linked digitally the FO, the FDC, and the guns. Instead of producing a verbal call for fire via radio, the observer could input the fire information directly into a manpack terminal device. However, with the digital revolution of the 1980s, the system was virtually obsolete as soon as it was fielded. It was phased out by 1995, and a completely digitized system, the Advanced Field Artillery Digital Data System (AFATDS), superseded it. The development of the Global Positioning System (GPS) in the 1980s greatly assisted field artillery fire support. The GPS allowed observers and gunners to accurately locate guns, observer locations, and targets without the need for time-consuming surveys.[5]

Technology also affected field artillery munitions in the form of precision munitions. Fielded in 1984 for the 155-mm howitzer was the cannon-launched guided projectile (CLGP) or Copperhead round. Copperhead had a laser targeting device in its nose that allowed an observer with a laser designator to guide the round to a point target. In tests, Copperhead had a 70-percent accuracy rate. Most misses were based on human error rather than technical failings.[6]

FASCAM was a family of scatterable mines. A FASCAM round was fired into a target army and its bomblets popped out and produced an instant minefield that could be set to explode and dissolve after a certain number of hours. Dual-purpose improved conventional munitions (DPICMs) were an improvement on the previously fielded improved conventional munition (ICM) rounds. The DPICM was an antipersonnel round containing packed bomblets that on release exploded over the target area. Both FASCAM and DPICM proved to be a double-edged sword when bomblets frequently did not explode and became a ground hazard to friendly troops, particularly in Operation DESERT STORM.[7]

Precision munitions allowed artillery, an area fire weapon since 1914, to hit point and moving targets with a high degree of accuracy. However, field artillery use of such munitions had a lot of overhead. The rounds were expensive; an observer had to have line of sight with the target. Targets were limited to the line of sight of observers on the ground, which terrain or enemy fire often restricted. Eventually, air-delivered precision munitions, therefore, became the preferred method of employment for precision munitions.

During the 1980s, the Army fielded improved guns, including a new 155-mm towed howitzer. For counterfire, each division received a multiple launched rocket system (MLRS) battery. The MLRS provided the ultimate in artillery area fire. Its 12 rockets could saturate a 1-kilometer grid square with bomblets in less than a minute.[8]

Deep Attack and the Development of the Divisional Aviation Brigade

Despite the cancellation of the Cheyenne program, the transformation of one of the two Army air assault divisions into an armored unit and the reduction of the aviation battalion in many Army divisions to a single company, review of the Vietnam experience reflected on the importance of attack helicopters in close support of ground troops. Army leadership saw the development of this capability as the most significant outcome of the war. A Defense Department study in 1971 further validated the Army's

view that armed helicopters were a component of landpower that did not usurp the Air Force CAS mission.[9]

Many Army aviators and senior Army officers stressed the special characteristics of the attack helicopter. Many of these characteristics, such as agility, speed, and employment flexibility, were similar to those of Air Force aircraft. However, the attack helicopter also had a battlefield maneuverability that made it particularly capable in supporting ground maneuver operations. Army Chief of Staff General Creighton Abrams commented to Congress in April 1973 that "the attack helicopter's unique ability to provide precise close in fires to the engaged infantryman is essential."[10]

Although some members of Congress still expressed concern over the attack helicopter's vulnerability to ground fire, by 1973, weapons technology had advanced greatly to improve the capabilities of the attack helicopter, particularly in the antiarmor role where the fielding of a Cobra-mounted version of the TOW ATGM made that system much more lethal. Tests conducted in Germany in 1973 and 1975 reaffirmed this advance. In 1973, Congress funded a new Advanced Attack Helicopter Program (AAHP) to replace the Cheyenne program. The AAHP produced the AH-64 Apache a decade later.[11]

Doctrine writers who also projected the operational use of attack helicopters remained committed to the support of ground operations in the 1976 edition of the Army field service regulation, Field Manual (FM) 100-5, *Operations*. However, in 1977, TRADOC received a new commander, General Donn Starry, who had new ideas. Starry had previously commanded the V Corps in Germany and, in that capacity, had extensively studied Soviet doctrine. Starry feared that the then-current US Army active defense doctrine did not adequately account for the depth in which the Soviets planned to array their forces as part of the offensive operational maneuver concept.[12]

Starry's response to this threat was the deep attack. He projected the use of available long-range Army artillery and Air Force strike assets to conduct independent attacks against Soviet second-echelon forces deep to the rear of the front line. By 1982, doctrinal literature considered the deep attack an essential part of Army operations and an important component of Starry's new doctrine called AirLand Battle.[13]

By its nature, the deep attack required Air Force participation. In 1982, the Army did not field an attack helicopter capable of conducting the operations that Starry envisioned. Starry's staff worked closely with the

Air Force's Tactical Air Command, headed by General William Creech, to develop AirLand Battle on a joint basis. The two generals signed a joint operational concept document in April 1981. This agreement and several others concerning various areas of Air Force support to ground operations promulgated in 1980 and 1981 defined the Air Force role in deep attack. Deep attack was essentially the traditional USAF concept of interdiction. However, under AirLand Battle, communications and coordination channels were streamlined at various command echelons.[14]

Initially, the attack helicopter was excluded from the deep attack equation because of the limited capabilities of the AH-1 Cobra. However, when the AH-64 Apache began fielding in January 1984, deep strikes became a primary mission of units equipped with the new system. The Apache mounted a 30-mm cannon and an advanced ATGM, the Hellfire, which could be fired precisely onto a target at great distances using a laser designator targeting system. The new aircraft also had a range of 90 miles, giving it the ability to move deep into the enemy rear area. Army doctrine writers listed aviation for the first time as a separate maneuver arm in the 1986 version of FM 100-5. More directly, the manual, while mentioning the role of Army aviation in supporting ground maneuver, also cited that it "increasingly offers opportunities for actual maneuver by air."[15]

The Army had established a separate Aviation branch on 6 June 1983. By this time, a combat aviation brigade, comprised of a mix of attack helicopter, air cavalry, and support aviation units, existed in every Army division. The doctrinal shift to the deep attack, along with the establishment of the branch and the creation of the brigade, marked the culmination of the transformation of Army aviation from an auxiliary support element to a maneuver arm in its own right.[16]

The inclusion of an aviation brigade in the division starting in 1983 completed a process that began in the early 1970s. A 1973 study had recommended including an attack helicopter company in each division to provide antiarmor firepower. The mission emphasis for the attack helicopter shifted to the antiarmor role with the fielding of the helicopter version of the TOW ATGM and the Army's renewed interest in the European theater, resulting from a large buildup of Soviet forces there in the late 1960s.[17]

The amount and types of aviation in the Army divisional structure had fluctuated since the adoption of ROAD in 1962. The ROAD organization initially included an aviation battalion in each division. This battalion was more a transportation unit than a fighting one, providing command and control helicopters and limited troop and supply transportation. In

the ROAD armored and mechanized divisions, which did not deploy to Vietnam, the Army reduced the aviation element first to a company, then removed it altogether as more helicopters were needed in Southeast Asia. In 1970, an aviation company was restored to these units. In Vietnam, each deployed division retained its organic aviation battalion, with some units receiving additional companies or battalions for extended periods.[18]

US Army photo

Figure 32. The AH-64 Apache Longbow attack helicopter.

Throughout the immediate post-Vietnam period, the Army experimented with various reconfigurations of its combat forces. The one that was eventually adopted was called Division 86 and later the Army of Excellence (AOE). Starry and TRADOC initiated this program in 1978 as an attempt to provide updated Army organizations for the new family of equipment, including the Apache, which the Army fielded in the 1980s. For the attack helicopter, the original concept was to add an air cavalry combat brigade built around two attack helicopter battalions similar to the already fielded 6th ACCB. However, unlike the ACCB, the divisional brigade needed to contain elements other than air cavalry and attack helicopter combat units that were necessary to transport troops and supplies and to allow commanders to move around the battlefield swiftly.[19]

The final structure of the brigade is shown in figure 33. The former divisional aviation battalion became the new brigade's assault helicopter battalion. Once fielded, the UH-60 Blackhawk tactical troop transport helicopter became the main piece of equipment of the battalion. The brigade also included one or two attack helicopter battalions. These units contained the new AH-64 Apache in the armored and mechanized divisions and modified OH-58D Kiowa observation helicopters to a light attack configuration in the light and airborne divisions.[20]

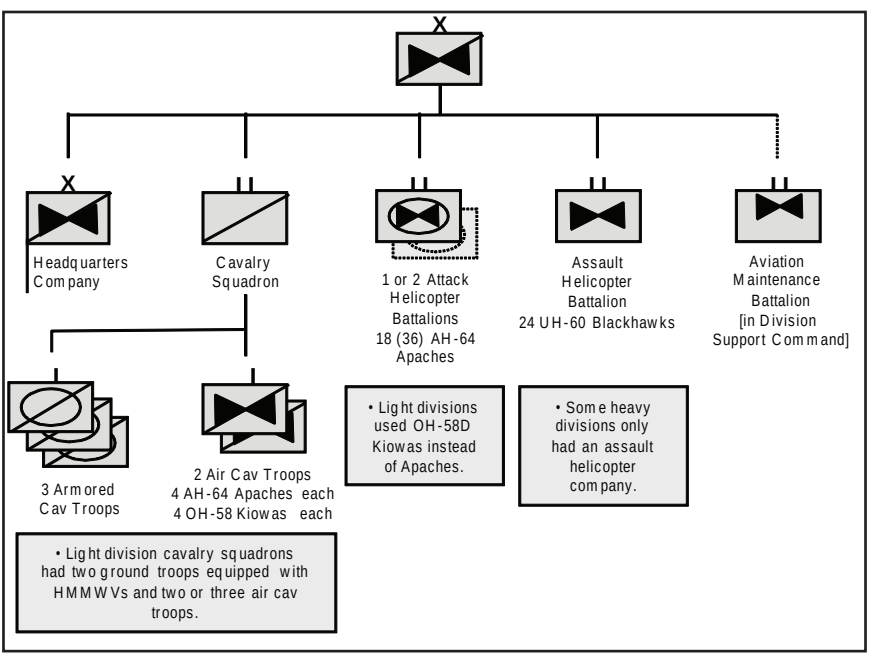

Figure 33. Divisional aviation brigade, 1986.

The new brigade also contained the divisional reconnaissance unit known as the cavalry squadron. This organization had traditionally been placed directly under the division headquarters. The former armored cavalry squadron had contained a single air cavalry troop. The new structure retained three ground troops equipped with armored vehicles or high-mobility, multipurpose wheeled vehicles (HMMWVs) and two air troops with an equal number of Apaches and Kiowas each. Army planners placed the squadron under the aviation brigade because the consolidation of all aircraft in the division under one command was considered most important even if it resulted in the brigade receiving two or three troops of ground elements as well. In actual practice, the cavalry squadron was usually split into ground and air sections with the aviation brigade controlling the air troops and the division commander retaining the ground troops under his direct command.[21]

Doctrinally, the Army considered the new divisional aviation brigade to be a maneuver unit. In fact, although the brigade had the official designation simply as "aviation brigade," official documents and other literature often referred to the unit as the "4th Brigade" (the three ground maneuver brigades were numbered sequentially) or as the "combat aviation brigade (CAB)." The traditional maneuver arms were infantry armor and cavalry. These elements maneuvered against the enemy and took and held ground. The attack units of the aviation brigade provided the basis for its consideration as a maneuver brigade.

Starting in 1985, Army divisions began creating their aviation brigades. The concept of the aviation brigade as a maneuver element remained somewhat controversial in the Army. Originally, the emphasis was on target servicing. But, by the time of the actual fielding of the brigades in 1985, the emphasis had shifted to the role of attack aviation as a maneuver element. But, clearly, the aviation brigade could not take and hold ground unless reinforced with nonaviation combat units. General William Richardson, a successor to Starry as TRADOC commander, referred to the brigade as "a maneuver element capable of multifunctional use."[22]

Clouding the issue of the brigade as a maneuver command was that it contained and controlled aviation assets whose roles were intrinsically combat support. In particular, the assault helicopter battalion provided airlift to combat units and helicopters for commanders, and the cavalry squadron was, although placed in the aviation brigade, really a divisional asset. Upon the formation of the aviation brigade, some division commanders even issued orders placing the squadron under direct divisional control. It was clear that, despite doctrinal proclamations, the aviation brigade was not the same as a ground maneuver brigade based on its permanent structure.[23]

There were many good reasons for creating an Army Aviation branch in 1983. A 1982 Army study group believed that aviation doctrine and training was in such disarray that only creating a single branch could fix it. At the time, aviation officers belonged to a different ground branch, usually Armor, Artillery, or Infantry. Five different branches or schools held proponency for various aspects of the aviation effort. The new branch consolidated the management of Army aircraft and aviation doctrine under one group.[24]

However, the branch decision was not without detractors, particularly from a group of retired generals that included Howze. These senior officers feared that Army aviation leaders would lose their understanding of ground

operations and aviation's role in relation to it. This understanding had been gained from experience while serving as ground soldiers under the old system before becoming aviators. Some of the generals believed that the various missions and roles of Army aviation were too different to combine under one branch. There was also a fear that the new Aviation branch, similar to the Air Corps before it, would seek out an independent role apart from the combined arms tradition of the ground branches. The deep attack concept provided just such a role.[25]

US Air Force photo

Figure 34. A-10 Thunderbolt II formation.

Air Force Developments in the 1970s and 1980s

As part of the Cheyenne tradeoff, the USAF developed the A-10 Thunderbolt II specifically as a CAS aircraft. The A-10 was fielded between 1977 and 1984. Its original primary mission was to destroy massed Soviet armor and integrated air defense systems. The craft contained a nose-mounted 30-mm cannon similar to that mounted on the German World War II Stuka antitank fighter-bomber. Under its wings, the A-10 could carry a variety of munitions, including 500-pound bombs, Sidewinder air-to-air missiles, and Maverick air-to-ground missiles. The A-10 design, based on a large wingspan and big ailerons, made it highly maneuverable at slower speeds and lower altitudes. It did not require long runways and could loiter for hours. Its cruising speed of 300 knots was far slower than other jet fighter-bombers.[26]

Although the mainstay of USAF close air support in the modern era, once deployed, the A-10 proved to be as versatile as any multifunctional airplane that the Air Force ever fielded. When the Air Force began phasing out the Vietnam-era OV-10A air forward air controller (AFAC) aircraft, a modified A-10 designated the OA-10A, became the new AFAC platform. A-10s also conducted air interdiction and combat search-and-rescue missions.[27]

Much as the Army did with the FIST in the 1970s and 1980s, the Air Force began to increasingly professionalize the TACP after Vietnam. While the leader of the TACP, formerly called the FAC, but now referred to as the air liaison officer (ALO). ALOs formerly had to be pilots, but now other flying officers, such as navigators and weapons system officers could be ALOs as well. The teams contained specially trained senior NCO airmen called ROMADs, which originally stood for radio operators, maintainers, and drivers, but since ROMADs have assumed a greater role in calling in airstrikes, they have been recast as recon, observe, mark, and destroy.[28]

In 1994, with the Cold War over and special operations forces (SOF) having played an important role in both DESERT STORM Scud hunting and in operations in Somalia, the Air Force created its first SOF TACPs. ROMADs attended Army Special Forces (SF) training and then were assigned operationally to Army SF units. Initially, the SOF TACPs were designed merely to teach SOF how to conduct emergency CAS missions. But they soon became a permanent feature.[29]

Table 4. Warden's Five Rings

1. Leadership and command and control nodes.
2. Essential services such as electricity.
3. Infrastructure—roads, bridges, airfields.
4. Population.
5. Enemy army in the field.

Operation DESERT STORM

The deep attack doctrine was put to the test at the beginning of the DESERT STORM campaign as part of a special operation. In January 1991, an Army aviation task force (TF) (TF *Normandy*) spearheaded the air campaign by attacking and destroying two Iraqi air defense missile and communications sites 150 miles deep inside Iraq. The task force was organized under the commander of one of the attack helicopter battalions in the 101st Airborne Division (Air Assault), the Army's only air assault

division, and consisted of roughly half of the battalion's 18 AH-64 Apaches, supported by several Air Force special operations helicopters.[30]

Apart from TF *Normandy*, commanders did not use their divisional aviation brigades in an independent role in DESERT STORM. In general, the brigade elements were used in various ways to support the parent unit's ground maneuver with the brigade headquarters functioning as the clearinghouse for aviation missions. The Army estimated that Apaches destroyed more than 500 Iraqi armored vehicles.[31]

The 1st Armored Division provides an example of the typical operations of a divisional aviation brigade in DESERT STORM. At the start of the ground campaign, the brigade attached one of its two Apache battalions to the corps armored cavalry regiment. The brigade used the remaining attack battalion to support the division by advancing in front of the ground elements and attacking key Iraqi unit positions. During the night before the division's main attack on the Republican Guard, Apaches and Kiowas conducted four separate attacks, reducing significantly the effectiveness of the Iraqi defenses and then pursuing and attacking Republican Guard armored vehicles as they attempted to escape to the west and north.[32]

The US deployment to Saudi Arabia emphasized the role of field artillery. As part of the DESERT SHIELD buildup, the Army dispatched 43 field artillery battalions with 296 howitzers and 7 rocket artillery (MLRS) battalions. With 53 maneuver battalions (19 tank, 16 mechanized infantry, and 18 infantry) deployed, this left a ratio of more than four-fifths of a cannon artillery battalion for each maneuver battalion. Including the rockets, the ratio was almost 1 to 1.[33]

In the years before DESERT STORM, airpower theorists, particularly Colonel John Warden, revived the concept of the decisive role of airpower. In a revival of a pre-Hiroshima concept of nonnuclear strategic air warfare, Warden postulated that airpower alone could win wars if properly planned and executed. In essence, his theory, as illustrated in his 1988 work, *The Air Campaign: Planning for Combat*, can be viewed as interdiction on steroids. Warden thought a comprehensive and systematic campaign should follow a series of phases to destroy the enemy system. He presented a construct of five rings to be attacked in succession (table 4). The DESERT STORM air campaign followed Warden's pattern (and was partially planned by him).[34]

Before operations began against Iraq, the commander of the US Central Command (CENTCOM), General H. Norman Schwarzkopf, the theater commander for Operation DESERT STORM, appointed the

commander of the Central Command Air Forces (CENTAF). General Charles Horner, as the Joint Forces Air Component Commander (JFACC), controlled the employment of all air assets. His staff drew up a detailed, four-phased plan for air operations. Planners originally envisioned a 32-day campaign (figure 35), with the first 16 days devoted to a separate air campaign followed by a 16-day joint ground-air campaign. The original plan contained four phases. The first phase was a week-long strategic air campaign, follow by the attainment of air supremacy in the Kuwait theater and, in the 10 days before the ground offensive, attacks against the Iraqi Republican Guard and the other defending Iraqi forces. Since the length of the air campaign was predicated on the attriting of the Iraqi defenders to 50 percent of effectiveness and destroying the Iraqi infrastructure and isolating the Kuwait Theater of Operations (KTO), the duration of the air campaign was only tentative.[35]

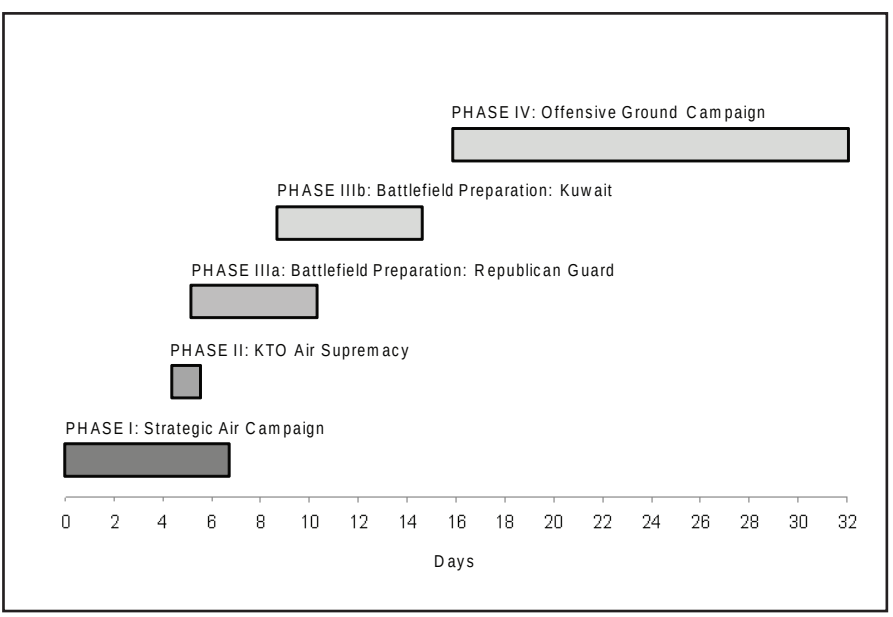

Figure 35. Estimated theater campaign phase lengths.[36]

When executed, the air campaign lasted for 43 days (18 January–24 February 1991), including 38 days before the ground offensive. The campaign followed Warden's five rings, but many of the different levels were executed concurrently. The Iraqi population was not attacked. Instead, Iraqi air defenses were substituted.

Horner managed the air campaign by creating a master air plan (MAP) and the air tasking order (ATO). The MAP planned out the campaign and the goals for each day. It was constantly updated. The ATO was the

execution document. Published daily, it provided specific guidance for the aircrews. The process worked best in the early days of the campaign when the impact of previous operations or Iraqi response was not a factor.[37]

The air campaign was the first major operational usage of precision guided munitions (PGMs). As such, they had devastating effects on the enemy. In terms of close air support, the air campaign shifted to degrading the Republican Guard, which Schwarzkopf had declared to be the enemy's center of gravity. In the week before the ground offensive, air assets pounded the Iraqi troops defending the front line, with stress on artillery, which was the most dangerous threat to the soon-to-be advancing ground troops.[38]

The air offensive was so successful that, when the ground attack began on 24 February 1991, it only lasted 100 hours, and the Iraqi forces were routed. Under these circumstances, CAS missions were virtually unnecessary. Therefore, during the advance, most CAS aircraft concentrated on interdiction missions.

The A-10 and F-111 were the primary CAS aircraft, although F-16s and F-15Es were also used. As these aircraft moved deeper into the Iraqi rear area, the A-10s proved to be vulnerable to the extensive air defense network. Two were shot down on 15 February 1991.[39]

Figure 36. The F-111 fighter-bomber.

The F-111 Aardvark was a fighter-bomber designed to penetrate

enemy air defense at a low level and at long range. The USAF used it from 1967 to 1998. It was used in the later stages of the Vietnam War, particularly at the defense of An Loc in 1972, and against Libya in 1986. The F-15E Strike Eagle entered service right before DESERT STORM and was the USAF's premier air superiority fighter. It is still in service. The F-16 Fighting Falcon entered operational service in 1980 and is the USAF's most numerous multifunction fighter.

The air campaign was a great success. Iraq was strategically crippled in less than 4 weeks. The rapidity of the ground campaign encouraged theorists like Warden. It seemed the air campaign had almost singlehandedly defeated Iraq. The next step would be taken several years later in Kosovo.

There were no air-ground controversies during DESRT STORM. The usual cause of such events is a shortage of air or other fire support assets. Such a shortage did not exist in Southwest Asia in 1990–1991. Perceived lack of support was not an issue. In terms of leadership, Schwarzkopf at the top firmly controlled things, including the activities of his air chief, Horner. For the first time in a major operation, the USAF employed a dedicated CAS aircraft, the A-10. During the ground campaign, the allotment of CAS missions was not an issue because the preliminary air campaign had eliminated the need for CAS missions. There were few viable targets left.

The largest single air loss of the war was the shooting down of an AC-130 Spectre on 31 January 1991 at Khafji, the first direct encounter between Coalition forces and elements of the Iraqi Army. While Marine and Air Force aviation played a big role in repulsing the small Iraqi offensive, an Iraqi surface-to-air missile (SAM) shot down the Spectre, which crashed into the Persian Gulf with the loss of the 14-man crew. The long-range significance of this incident was that AC-130s now would never fly in the daytime in combat situations.[40]

Afghanistan

In the wake of DESERT STORM**,** NATO conducted a series of operations in the Balkans (Bosnia, Kosovo) to pacify competing ethnic groups in the remnants of Yugoslavia. In Kosovo, a district of Serbia with a majority Albanian population, the Serbian Government began conducting an ethnic cleansing campaign. To stop the Serbs, NATO executed a 78-day air campaign against Serbia from March to June 1999 similar to the 1991 DESERT STORM air campaign. At the end of this period, the Serbian President, Slobodan Milosevic, agreed to withdraw his forces from Kosovo. NATO forces entered Kosovo 20 days later.[41]

The A-10 played a prominent role in Kosovo, forming three provisional expeditionary fighter squadrons. The A-10s served as airborne FACs and as ground attack aircraft. In contrast, the Army had trouble deploying Apache attack helicopters for the operation out of Albania due to maintenance and training concerns.[42]

The Kosovo campaign set up the model for airpower alone defeating a nation-state. The Serbian situation was, however, unique. All the European powers, plus the United States, and even in the end Russia, were against Milosevic. The bombing campaign devastated the Serbian infrastructure. Milosevic realized he could not resist a NATO ground offensive in Kosovo. He cut his losses and withdrew. Nevertheless, the operation showed the flexibility and capabilities of airpower.

The opening action of the War on Terrorism introduced another new paradigm to the air campaign without the US ground forces dynamic. In the campaign that began on 7 October 2001, a combination of Afghan Northern Alliance tribal forces and Army SF and SOF teams supported by Air Force SOF TACPs toppled the Taliban regime and forced the large al-Qaeda contingent to flee to the rugged mountainous area on the eastern border of Afghanistan next to Pakistan.[43]

The employment of a combination of SOF, proxy forces, and airpower became known as the Afghan model. While successful, circumstances and geography forced the Afghan model on the American military. Afghanistan is an isolated, mountainous, landlocked country. The logistics of bringing adequate US ground forces into the region without a firm base in the country was tremendous. Meanwhile, the need for some kind of relatively immediate response to the 9/11 attacks was necessary. The Afghan model was, therefore, the only solution.[44]

Since DESERT STORM, the USAF had integrated PGMs into CAS operations. In Afghanistan, PGMs proved to be decisive in toppling the Taliban. Without the deployment of a conventional chain of command to Afghanistan, the SOF TACPs did not use the conventional Air Force tactical air control system or the Army's parallel air-ground system. Instead, TF *Dagger*, the Army-led SOF higher headquarters, did all the CAS control functions, first with a team of Army SF soldiers, then later with an Air Force cell. The Air Force and Army personnel integrated their activities together, and the streamlined CAS process was tweaked and improved as the operation continued. After the sudden fall of Mazar-e-Sharif on 9 November 2001, the rest of the country quickly fell to the Northern Alliance with Heart on 12 November, Kabul on 13 November, and Kandahar on 7 December.[45]

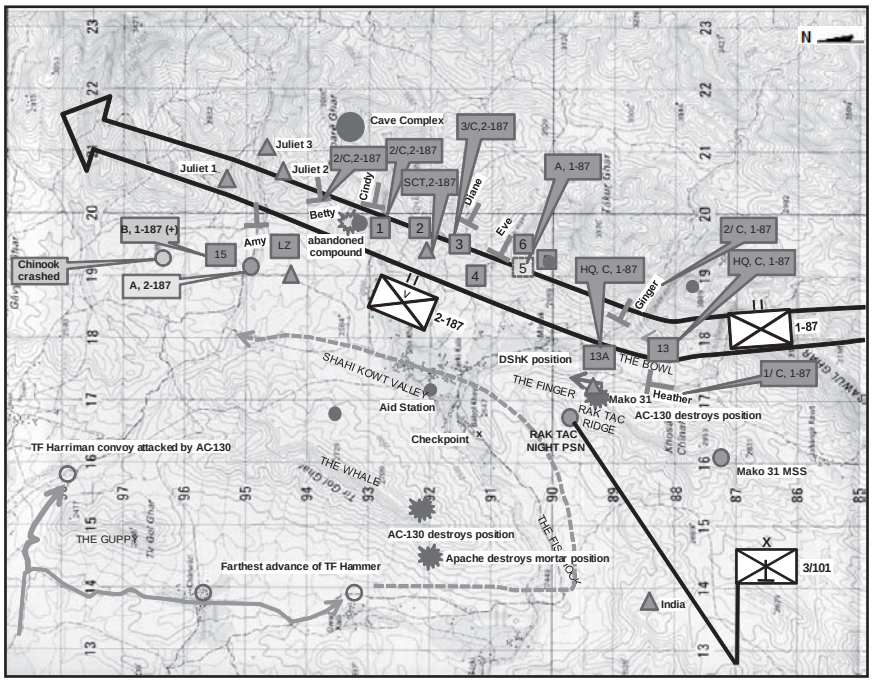

Figure 37. Operation ANACONDA.

Following several months after the defeat of the Taliban, Operation ANACONDA was the first major US ground combat action of the War on Terrorism (figure 37). It was a multinational operation consisting of a mix of conventional and SOF forces in the Shahi-kowt Valley in Paktia Province, Afghanistan, in March 2002. ANACONDA was also a landmark in the relationship between close air support and field artillery. For the first time since Buna, airpower provided a deliberate substitute for field artillery. The Army brigade from the 101st Airborne Division (Air Assault) committed to the operation did not deploy to the theater with its organic 105-mm field artillery howitzer battalion. Even the three battalions of conventional infantry only brought portions of their company and battalion mortars to the operation. The ground soldiers entered battle with far fewer fire support assets than that with which they had been trained. The background for this decision has its origins in the 1991 Gulf War and subsequent Army policy decisions.[46]

As related previously, Operation DESERT STORM in 1991 was the culmination of two consecutive 3-month deployments of corps-size combat forces. Based on intelligence estimates that gave the Iraqi Army a much higher level of combat effectiveness than it had ever displayed, Army commanders Generals Powell and Schwarzkopf had wanted to

ensure enough ground forces were on hand to decisively defeat the Iraqis. After a month and a half air campaign, the ground battle only lasted 4 days and resulted in a great victory. Outside the Armed Forces, observers could view the 6-month deployment as overblown in size and excessive in time due to an inaccurate assessment of Iraqi capabilities.

Within the Army, DESERT STORM validated a new doctrinal concept called decisive force, whose primary proponent was the Chairman of the Joint Chiefs of Staff, General Colin Powell himself. Decisive force postulated that the Army would never initiate a fight without enough forces available to win the fight decisively. Potentially protracted wars should be avoided. Conflicts should be fought with sufficient forces to end them quickly.[47]

In theory, decisive force sounded right. The wrinkle was in the estimate of what equaled decisive force. During DESERT STORM, the Army still was large from the Cold War. However, in the 1990s, the military forces of the United States downsized drastically. The use of a large force for a small operation could cripple US military operations elsewhere. Ironically, the new Bush administration that took office in early 2001 preferred to maximize technology and minimize personnel.

New Secretary of Defense (SECDEF) Donald Rumsfeld in particular saw operations like DESERT STORM as massive overkill. The Army was too heavy, took too long, and wanted to bring too much stuff with it to attain decisive force.

To the new SECDEF, the field artillery, symbolized by its new Crusader 155-mm weapons system, was the personification of what he felt was wrong with the Army. While the Crusader marked the first new version of the standard Army self-propelled howitzer since the 1960s and was technologically the state of the art capable of firing accurately on the move. Rumsfeld rejected its weight, which made it difficult to ship overseas in large numbers. The SECDEF canceled the Crusader in May 2002.[48]

With austerity now a prime consideration, the desire to leave behind field artillery and replace it with air assets already operating in the theater seemed like a reasonable, if unusual, decision. The decision to depend on air support from other services further complicated an already excessively detailed task organization. The mix of special operations forces, conventional forces, Afghan troops, Army and Air Force aviation, and a laboriously complicated operational chain of command extending back to Central Command headquarters in Tampa merely exacerbated the usual tricky relationship involved in employing joint fire support.

The operation had the objective of destroying the al-Qaeda/Taliban presence in the valley. This was to be accomplished by placing US forces in blocking positions at the base of the mountain range to the north of the valley. Then, a force of friendly Afghan fighters would enter the valley from the south and clear the valley, forcing the enemy to retreat to the north into the arms of the waiting US forces. Air support would soften up the valley before the US forces landed by helicopter and the Afghans attacked up the valley.

Virtually nothing went according to plan in the subsequent operation. The al-Qaeda enemy occupied not just the valley but the high ground both to the north and the south of the valley. Coordination difficulties affected air support from the start. The expected 55-minute preliminary aerial bombardment to precede the Afghan assault, due to a coordination mishap, lasted only a minute. To add insult to injury, an AC-130 gunship had just fired on an Afghan column, totally disrupting it and killing an American SOF NCO. The Afghan forces never got into the valley. Meanwhile, the US infantry forces landed and occupied their blocking positions only to find that the enemy dominated the positions with fire from high on the mountains to the north. The battle turned into a defensive one where the US infantry repulsed massed enemy attacks and endured al-Qaeda mortar and artillery fire. Eventually, the US forces consolidated in the western end of the valley. After being reinforced, the valley was cleared, while a poorly planned secondary action at the top of the highest mountain in the area, Takur Ghar, ended in a crashed Chinook CH-47 cargo helicopter and a pitched battle between SOF and al-Qaeda fighters, which ended in the destruction of the al-Qaeda force and the deaths of seven SOF servicemen. Apart from Takur Ghar, ANACONDA was a success, although little of the battle had taken place according to plan. Most of the al-Qaeda forces in the area were destroyed and the valley base area was cleared.[49]

The terrain, coordination difficulties, and operational factors affected the responsiveness of air support. The available SOF AC-130s, because of Khafji, could only fly at night. The terrain limited attack runs and rules of engagement initially complicated targeting. Coordination issues were, understandably, numerous. The order of battle for the operation consisted of a mix of SOF and conventional air and ground units from two services and the Afghan Army. Without conventional forces in the theater, the SOF had developed unconventional air-ground procedures. Now, with the introduction of US ground troops, the air-ground system was not refined enough to work without snags.

In an article in the September–October 2002 issue of the *Field Artillery Journal*, Major General Franklin Hagenbeck created a mild controversy when he commented on the time lag of up to hours for the execution of airstrikes equipped with precision munitions. Hagenbeck also stated he would have not brought his organic 105-mm howitzers into Shahi-kowt on the first day because of transportation and protection requirements and he may not have used them at all, even if they were available, because of the ruggedness of the terrain and lack of roads. Hagenbeck also cited the Apache attack helicopter as the most responsive air support platform he used in the operation.[50]

As in the case of Buna, the relative characteristics or effectiveness of field artillery and close air support was not the determining factor in the choice of close air support over field artillery. In both cases, logistical and transportation requirements were prime considerations. Also, in both cases, close air support had difficulties early on. Additionally, the presence of the missing artillery, as at Buna, would have probably only had a minimal effect on operations.

While, overall, the Afghanistan model of using proxy forces, SOF, and airstrikes did not work well in the Shahi-kowt Valley against a determined force of diehards. The best use of airpower came at the hands of the small SOF observation posts established in overwatch positions around the valley before the start of the operation. Observers from these locations routinely called effective airstrikes on point targets in the valley and on the mountains throughout the early part of the operation.

Operation IRAQI FREEDOM

There was no large-scale air campaign before the 2003 Baghdad campaign. The air campaign was conducted concurrent with the ground campaign. The austerity seen in Operation ANACONDA was also apparent in this campaign. The Iraqis were no longer considered the formidable foes of 1991, although they did turn out to be still less formidable in the opening campaign than expected and more formidable in the ensuing insurgency.

The Baghdad campaign proved to be an excellent example of an integrated joint combined arms campaign. As in DESERT STORM, there were no controversies between air and ground operations. The attack helicopter played an important role in the ground portion of the Baghdad campaign, both in support of their parent unit and as an independent strike force. In the latter case, the results were not as expected in the first battlefield use of the deep attack concept.

Aviation brigades were used in many of the contingency operations in the 1990s, primarily in a support role. In Somalia, the 10th Mountain Division's aviation brigade acted as a maneuver headquarters in 1993 when it controlled three battalions, only one being an aviation unit. During operations preceding the Kosovo peacekeeping operations in 1999, the American NATO commander sent a two-battalion Apache task force (TF *Hawk*) from a brigade in Germany to Albania. TF *Hawk* was to conduct a deep attack against Serbian armored forces in Kosovo. But the mission never happened. Logistical baggage delayed the deployment. For various reasons, the Apaches never conducted operations against the Serbs.[51]

Although the Cold War was over and there were few opportunities to employ the maneuver, deep attack remained an important operational concept when US Army forces entered Iraq to initiate Operation IRAQI FREEDOM (OIF) in March 2003. In the initial OIF campaign, the Army deployed two divisional aviation brigades, the attack brigade of the 101st Airborne Division (Air Assault) and the aviation brigade of the 3d Infantry Division (Mechanized). The higher Army command, V Corps, had an additional brigade-size force at its disposal: TF *11th Aviation Group* (TF *11*), consisting of three Apache battalions.

The 3d Infantry Division (Mechanized) did not conduct any deep operations with its attack helicopter battalions. In fact, one finding of the division's after-action report was that divisional attack helicopter battalions were best used in close operations to support the division's ground maneuvers. This finding shows that the employment of the aviation brigade and the deep attack, the placement of the aviation brigade under the division, a ground tactical unit, tempers its employment to the priorities of the division and its operations rather than to independent aviation missions.[52]

On the other hand, both the 101st and TF *11* elements attempted to conduct deep strikes with massed Apache units. TF *11* conducted an unsuccessful two-battalion (30 Apache) deep strike on the evening of 23–24 March 2003, 3 days after the start of the campaign. Plans called for TF *11* to strike at the start of the campaign, but a combination of bad flying weather and the rapidity of the advance redefined the force's mission. The campaign plan called for an operational pause at Najaf before a final advance on Baghdad and included a projected deep attack on the armored units of the Iraqi Republican Guard defending Baghdad from the south before the second advance. TF *11* received this mission, which was designed to destroy a brigade of the Iraqi Republican Guard Medina Division, expected to be defending near the Karbala Gap and in the area between the gap and the Euphrates River, 60 miles south of Baghdad.[53]

Various events turned the operation into a fiasco where Iraqi defenders using small arms and messages communicated using cellular telephones and the prearranged blinking of lights put up such a level of fire that the Apaches had to return to base without having accomplished their mission, losing one helicopter to enemy fire and severely damaging most of the remaining aircraft in the strike force. Logistical and intelligence coordination failures, route selection, and Iraqi adaptability and quick reaction were important considerations. TF *11* was out of action for the rest of the brief Baghdad campaign.

Although its Apache units spent most of their time supporting the infantry units of the division, the 101st Division command and the aviation brigade still planned several independent long-range attacks. The 101st's attack aviation brigade executed two deep strikes, a two-battalion attack near Karbala on 28 March 2003, and a one-battalion mission near Ramadi on 5 April 2003. The first attack destroyed more than 200 enemy vehicles and weapons systems and the second more than 70 without the loss of any Apaches. The 101st had learned the lessons of TF *11*'s failure. Later success was due to thorough planning and effective route selection. The 101st's planners sent their Apaches over uninhabited terrain almost up to the attack objective. The helicopters returned by a different but similarly uninhabited route.[54]

The dichotomy between the close (3d Division) and deep (TF *11* and 101st Division) uses of the attack helicopter in the 2003 campaign reflects the two threads of usage of divisional aviation assets. Although the aviation brigade controlled all the aerial assets in the division, overall command remained with the ground-oriented division commander. Therefore, while the aviation deep attack remained a major part of Army doctrine, ground commanders circumscribed its use and were not willing to conduct such operations at the expense of supporting the ground troops of the division. The commander of the 3d Infantry Division was chiefly interested in advancing his ground forces to Baghdad as swiftly as possible. TF *11* and the 101st were initially in reserve or not fully assembled. The V Corps then committed the 101st to mopping up bypassed Iraqi positions in the rear of the 3d Division's advance. These differing combat situations gave the various commanders different perspectives on using their attack helicopters in close or deep operations.

Army doctrine in the post-Cold War era still included attacking enemy forces in depth. Aviation branch documents also stressed deep operations and that the optimum use of helicopters in offensive operations were against second-echelon enemy forces. However, close operations were given

equal importance, and the integration of aviation into ground operations permeated all discussions of aviation employment considerations.[55]

With the creation of the Aviation branch in 1983 and the concurrent conceptual shift to the view that aviation was a maneuver arm, it seemed, as with the Army Air Force before it, that Army aviation was moving away from supporting the ground commander to a more independent, more distant role. Contemporary analysts addressed this possibility. Some military observers, even from within the aviation community, believed that aviation officers were not well trained in combined arms operations and had become out of touch with the ground force operations they were supposed to support. Similarly, aviators and trainers cited that training rotations at the National Training Center (NTC) at Fort Irwin, California, did not adequately represent the role of attack helicopters.[56]

However, these fears were premature. In the years immediately before the War on Terrorism and in the operations in 2003, trends appeared that placed Army aviation more clearly as a member of the combined arms team rather than a developing, separate combat entity. NTC rotations began incorporating attack helicopter units as integral parts of the combined arms forces assembled to participate in the training. Army theorists began developing concepts that more closely tied aviation with the ground arms in works such as "Dominating Maneuver Synthesis Report" (1998) and *Air Mech Strike: Asymmetric Maneuver Warfare for the 21st Century* (2002). Operations in 2003, despite the defeat of TF *11*, clearly showed attack helicopters most often working closely with ground units, particularly in the Iraqi cities.[57]

While the Army considers aviation (i.e., attack helicopters) to be a maneuver element, pure helicopter units are not maneuver assets in the traditional sense. Helicopters can maneuver against enemy forces in that they can move to a position from which to place fires on the enemy. However, the aircraft cannot and do not remain or hold the positions from which they fire as do the traditional ground maneuver arms. After DESERT STORM, Army doctrine writers discussed the theoretical concept of whether fires could maneuver against the enemy. The definition of maneuver posted in the subsequent field service regulation seems to say fires do.[58]

Originally, the combat role of aviation was as aerial artillery or target servicing. With technological advances, attack helicopters became capable of moving against enemy forces deep behind the front line. However, such independent operations were susceptible to enemy air defenses and defenders alerted by modern communications networks. After the March 2003 deep attack failure, US Army forces restricted the use of their attack helicopter assets to more traditional close support missions.

Summary

Since 1975, both field artillery and close air support acquired precision munitions. However, the field artillery soon limited the use of such munitions to special situations, while the Air Force, with its greater ability to find lucrative targets, used such munitions in both strategic and tactical concepts. This revolutionized the relationship between artillery and aviation. The field artillery remained an area fire weapon, best able to limit the abilities of the enemy to fire or move in the presence of friendly forces. Tactical air, which had since World War II primarily used bomb loads for CAS operations, had also been an area fire weapon for the most part, although aircraft-mounted cannons gave CAS craft additional point target capabilities.

Air operations developed new paradigms. Operation DESERT STORM introduced the separate, virtually independent air campaign that almost brought a large nation to its knees. Kosovo presented a small nation being brought to its knees. In Afghanistan, the new paradigm was the combination of proxy forces plus SOF teams plus precision airstrikes equaled victory. However, in the subsequent Operation ANACONDA, the substitution of close air support for the traditional close support role of field artillery fell flat because of poorly coordinated airstrikes and an erroneous appreciation of the enemy situation. This latter operation showed the continued importance of close and effective coordination between ground and air forces.

The new paradigms all stressed the importance of airpower to ground operations. Effective airpower may preclude ground operations; it may facilitate ground operations so that 4 days is all that is needed to defeat a large enemy force; it may strengthen proxy forces to the point that they are able to accomplish what seemed impossible in a matter of weeks. However, these paradigms are all situationally based. The Afghanistan model so successful in November 2001 was far less successful in Anaconda in March 2002.

The Army deployed the attack helicopter in aviation brigades. The concept of an independent role for such craft received a bloody nose in its first attempt to conduct such an operation in Iraq in 2003. The Army's traditional concept of mutually supporting combined arms seems to apply to the attack helicopter as much as it applied to infantry, armor, and field artillery.

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Chapter 5

Conclusions

Over the last hundred years, both cannon field artillery and close air support have developed exponentially from their humble origins. This progress was both rhetorical and kinetic. The latter is reflected in the wars that the United States has fought. After complete unpreparedness in World War I, the field artillery has been prepared for each successive war. During the interwar period, the Field Artillery School developed the techniques and tactics that made American artillery the most effective in World War II. This tradition continued in later wars.

Close air support has had a more uneven record of preparedness. In both World Wars, the Air Service improvised CAS procedures and refined them by the end of the war only to have to reinvent similar procedures in the next war. The reason for this was a cyclical devaluation of close air support in favor of strategic bombing. This cycle finally broke with the adoption of flexible response by the Kennedy administration. The Air Force thereafter retained ground support operations as a major mission.

However, even under this construct, Air Force officers continually stressed the independence of air operations. At first, this was reflexive of the belief that strategic bombing would be decisive. When events proved that the United States would still have to fight conventional ground wars, Air Force doctrine split close air support into two pieces. Close air support itself now became support provided close to ground troops. Air interdiction was deeper attacks that could be executed against the enemy rear area without direct reference to the concurrent actions of the ground troops. Ironically, when the Army developed the attack helicopter as its own CAS force, eventually this force too advanced the concept of independent operations in the form of the deep attack. In American military history, this is a basic difference between air assets and the field artillery. At no point has the field artillery sought to conduct independent operations, a firepower offensive of sorts.

Air units and the field artillery have other distinct characteristics. However, there are also similarities. Until the development of precision guided munitions, both were essentially area fire weapons. Field artillery fire landed in an elliptical beaten zone around the target. Its effects were the ability to neutralize and disrupt any enemy forces in the beaten zone. While disrupted, the enemy cannot fire or maneuver against friendly troops.

In World War I, close air support was principally through the direct fire of machineguns against point targets. After the war, improved light bombers and fighter-bombers were developed. Accordingly, in later wars, close air support depended on bombing. This too made an area fire weapon, with its inherent inaccuracy. The principal difference between air and cannon fires during this time was in terms of range, responsiveness, and coordination. Before World War II, the US Army field artillery developed techniques that made it much more responsive to the ground maneuver units. Effective fires could come fast and impact close to friendly troops. As an area fire weapon, close air support also had certain advantages. It could apply the disruptive effect ranging deep behind the enemy lines. If massed, whole enemy units, such as *Panzer Lehr*, could be taken out of the fight even while losing minimal materiel.

Precision guided munitions revolutionized fire support. While PGMs were developed for both aircraft and field artillery, the limited range and field of vision of field artillery, particularly in difficult terrain, in relation to the high cost of PGMs meant that field artillery usage was usually reserved for special missions. Meanwhile, the Air Force adopted PGMs as its primary munition for its fighter-bombers and multifunctional aircraft. Therefore, in the last 30 years, there has been a distinct dichotomy between air and ground fire support. The air assets have become point fire weapons, while the artillery has retained its traditional, highly responsive area fire capabilities.

This dichotomy allows the two systems to complement each other as part of the joint combined arms team. The unique characteristics of the field artillery include the ability to operate close to and in cooperation with friendly ground forces in a timely manner and the ability to destroy or degrade the enemy's ground capability close to friendly forces. Artillery batteries can operate around the clock and at night. Effective communications, now digitized, and coordination channels have been well developed. Because of indirect fire, artillery has been able to position itself in survivable positions while still providing support. As a weapons system, it is also capable of quickly placing many rounds on a target and controlling a large area of action in front of its supported unit. The usual decentralized employment of field artillery units enhanced responsiveness.[1]

The field artillery has had certain limitations too. Its range is limited beyond its zone of action. Ammunition resupply increases the logistical load for the force. In rapid advances and retreats, it would have to displace, disrupting its ability to provide fire support. Additionally, terrain such as

mountains or jungles can disrupt its fires because field artillery depends on the ability of ground and air observers to identify targets.

CAS characteristics include a much farther range of operations than field artillery. Planes can mass against targets for devastating effects. Because the pilot views his targets directly, fires do not need to be adjusted and he can pick out targets of opportunity without requiring further coordination. With PGMs, aircraft fires can destroy specific targets with a minimum expenditure of munitions.

Air limitations include weather, the effects of enemy ground fire, and communications and coordination difficulties. The weather, including night operations, often can restrict air operations. Aircraft are susceptible to ground fire. A-10s could not operate in areas with a lot of air defenses. AC-130s were prohibited from daylight operations. Even with decentralized execution of air missions, immediate missions require the use of specialized TACP personnel with particular radio equipment. Strike aircraft require air- or ground-based guides to direct the pilot to the target. Coordination, particularly for preplanned fires, but even for immediate strikes, as seen in ANACONDA, can slow responsiveness.

Attack helicopters combine some of the characteristics of field artillery and fixed-wing aircraft. They combine the responsiveness of artillery with the point fire effects of CAS aviation. Attack helicopters can loiter for long periods in an area. Coordination of fires is simplified as they follow the same apparatus as field artillery. The weapon platform fires direct at point targets and is equipped with both PGMs and rapid-firing cannons and missiles. However, like fixed-wing aircraft, attack helicopters are susceptible to ground fire and bad weather.

Four themes from the Korean War provide good points on the Army-Air Force conflict in relation to close air support.

The first theme is the prioritization of air missions. Traditionally, this has been the prerogative of the air commander after receiving guidance from the theater commander, who has usually been a ground officer. Air Force doctrine stressed close air support as a lower priority mission than air superiority and air interdiction. This was only an issue when air assets have been limited, as they were in Korea. In World War II and DESERT STORM, such assets were virtually unlimited. Also in DESERT STORM, the success of the preliminary air campaign made close air support unnecessary during the ground campaign. In counterinsurgency operations, where the battlefield is frontless and troops are dispersed, the

distinction between close air support and interdiction becomes blurred to the point that both sides in the debate can interpret air missions as either.

The second point, the control and tasking of air missions, has been the most contentious. Even in field artillery, this has been a contentious issue at times, as seen in the disagreement between Hunt and Hancock at Gettysburg. In World War I, air support was under the control of the ground commanders. In World War II, the abundance of air support and the cooperative attitude of air commanders like Quesada smoothed over any difficulties. In Korea, ground commanders such as Almond fought for control over their air support because of a weak air-ground system. After Korea, the Army and Air Force forged together a system of cooperation and control that has worked well ever since. Difficulties in Afghanistan were based on a combination of factors, including inexperience, ad hoc changes in the system, and the dependence on unconventional SOF operators to run the system. In Vietnam and DESERT STORM, the system worked well. Horner's master air plan and air tasking order simplified tasking and control until the results of previous operations made the MAP a much more fluid document.

The third point was the centralization of air assets. This theme reflects the biggest difference in CAS and field artillery employment. Without losing any ability to mass fires, the field artillery, with its support relationships, operates in a decentralized manner. While the Air Service operated this way in World War I, it became axiomatic that airpower had to be centralized. In World War II, centralization was doctrinal policy, but the TAC commanders in Italy and the ETO decentralized the execution of CAS operations on a de facto basis. The issue did not come to a head until the Korean War when there were limited air assets and the newly independent Air Force forced the issue. However, as part of the more cooperative attitude between the services since Vietnam, the Air Force has adopted a policy of centralized planning and tasking and decentralized (albeit by Air Force personnel) execution. The placement of a TACP in the staff of Army maneuver battalions has facilitated this. In Korea, such parties were generally only at the division and regimental levels.

1. Long loitering capability.
2. Armor protection against ground fire.
3. Ability to carry a suitable load of weapons and munitions.
4. Engine with suitable power.

Table 5. CAS Aircraft Characteristics[2]

The types of aircraft for use in close air support have been a controversial issue for a long time. Since World War I, the Air Force has almost continually used planes for close air support that were originally developed for other missions (usually air superiority). In the mid-1930s, the Army Air Force went through a brief period where it fielded attack aircraft for CAS missions. However, before World War II, these aircraft were converted to light bombers. For CAS during the war, the AAF converted a number of fighters into fighter-bombers, which had great success in the later years of the war. By the time of the Korean War, the Air Force had begun fielding exclusively jet fighters, considered necessary to challenge Communist air forces, but less suitable for CAS operations. After first reviving several World War II aircraft designs, the Air Force then fielded a second generation of jets that could fit the role of the World War II fighter-bomber.

After Korea, the Army slowly and adeptly developed the armed helicopter to provide close air support, while the Air Force fielded a series of fighter-bombers capable of carrying nuclear weapons but less capable of conducting ground support operations. For Vietnam, most of these designs proved to be inadequate, and the Air Force had to adopt several Navy designs, particularly the F-4 Phantom to provide effective close air support. Additionally, a series of cargo planes were converted into specialized CAS craft.

Near the end of the Vietnam War, the Air Force, to preempt the development of the Army's projected advanced attack helicopter, the Cheyenne, agreed to develop a CAS-specific jet. While the Air Force produced the A-10 in the 1970s, the Army eventually received its advanced attack helicopter in the form of the Apache in the 1980s anyway.

One military observer has cited the ideal characteristics of a CAS aircraft, which are shown in table 5.

The A-10 design reflected this design. The plane is highly maneuverable at low altitudes and relatively slow speeds. It can carry a large bomb and missile load and has a large cannon in its nose designed after that found in the German World War II Stuka dive-bomber. In an ironic twist, the Air Force has begun to use the single-function A-10 in other missions such as FAC and search and rescue.

The US Army conducted two major operations where close air support was used in lieu of field artillery support, at Buna in 1942 and in Operation ANACONDA in 2002. In both cases, the substitution was

not done out of any belief that aircraft could outperform the artillery in terms of support. Ideally, the commanders involved would have preferred to have had both mediums available. The substitution was basically a logistical matter. In Buna, the operation was run via air transportation and resupply. Artillery pieces took up too much of the airload. The ground commander in ANACONDA cited the terrain and airlift as reasons why he would not have used field artillery, at least initially, even if the units had been available. At a higher level, field artillery units were not brought into Afghanistan at first because of austerity concerns. Air assets were already in the theater and available.

In both cases, the use of artillery would have had a minimal impact on operations. At Buna, both air support and the limited availability of artillery proved to be ineffective based on the difficult jungle terrain and the inexperience of the US troops, commanders, and airmen. At ANACONDA, the field artillery required security and would have become a big target to the enemy holding the high ground. Any supporting batteries may have had their hands full just to survive.

The two cases are not as anomalous as they first seem. Close air support has been used in the past in lieu of field artillery whenever guns were not available or when the terrain was otherwise prohibitive. Examples of the former include the D-day invasion, during the early days in Korea, and in 1952 when there was a 105-mm ammunition shortage.

This special study has been a historical survey and comparison between the two key elements of the joint combined arms team, indirect fire support, as provided by field artillery and mortars, and direct aerial fire support (close air support and interdiction) provided by aerial platforms (fixed- and rotary-wing aircraft). Cannon field artillery and close air support are complementary weapons systems, not competitors. They should be best used together in ways that maximize their strengths and minimize or cover for each component's weaknesses. This team then presents the enemy with a difficult, sometimes irresistible, force.

The biggest historical hindrance to this happening was the effects of institutional and organizational factors. Often, arguments in favor of or against certain arms have not been based on the capabilities or characteristics of the specific arms but on other considerations external to the objective, such as a doctrine of centralization.

Together, CAS and field artillery assets, along with the units they support, provide the joint combined arms team. While each component of the joint combined arms team has specific and complementary

characteristics, the basic historical contrast between close air support and field artillery fires has been threefold: responsiveness, precision, and organizational. The interpretation of these three factors and the application of these interpretations is the basic continuity that ties together the opposition between field artillery support and close air support.

In the modern technological age, military and civilian leaders often base organizational and employment decisions on certain components of the joint combined arms team not on military realities as to the usefulness or ineffectiveness of certain arms, but in terms of general policy guidelines or expediency. Such decisions can degrade the effectiveness of the long-developed joint combined arms team. However, the team has enough redundancy that the lack of one element can be tolerated in limited circumstances.

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Glossary

A

AAF	Army Air Force
AAHP	Advanced Attack Helicopter Program
ACCB	air cavalry combat brigade
ACP	air command post
ACP	air control party
ACTS	Air Corps tactical school
ADVON	advanced echelon
AEF	American Expeditionary Force
AFAC	airborne forward air controller
AFATDS	Advanced Field Artillery Digital Data System
AFCC	Air Force Combat Command
AGF	Army Ground Forces
AH	attack helicopter
AKA	*Artilleriekämpfungsgruppe* (counterbattery group)
ALNO	artillery liaison officer
ALO	air liaison officer
AOE	Army of Excellence
ARA	aerial rocket artillery
ARKO	*Artilleriekommando* (divisional artillery command)
ARST Program	Aerial Reconnaissance and Security Troop Program
arty	artillery
ARVN	Army of the Republic of Vietnam
ATGM	antitank guided missile
ATO	air tasking order
avn	aviation

B

bn	battalion
BSL	bomb safety line
btry	battery

C

CAB	combat aviation brigade
CAS	close air support

cav	cavalry
CENTAF	Central Command Air Forces
CENTCOM	US Central Command
CLGP	cannon-launched guided projectile
co	company
CONAC	Continental Air Command
CONARC	Continental Army Command
CSSG	Close Support Study Group
CTOC	corps tactical operations center

D

DASC	Direct Air Support Center
DASC	District Air Support Command
div	division
DIVARTY	division artillery
DOD	Department of Defense
DPICM	dual-purpose improved conventional munition
DS	direct support
DTOC	division tactical operations center

E

ETO	European Theater of Operations
EW	electronic warfare

F

FAA	Federal Aviation Administration
FAC	forward air controller
FADAC	field artillery digital automatic computer
FASCAM	family of scatterable mines
FDC	fire direction center
FEAF	Far East Air Force
FEKA	*Fernkampfgruppe* (long-range group)
FIST	fire support team
FO	forward observer
FSB	forward support base
FSCC	fire support coordination center
FSCOORD	fire support coordinator
FSO	fire support officer
FSV	fire support vehicle

G

GB	*group de bombardment* (bomber squadron)
GC	*group de combat* (fighter squadron)
GHQ	general headquarters
GPS	Global Positioning System
GS	general support

H

HMMWV	high-mobility, multipurpose wheeled vehicle
HQ	headquarters

I

IBB	*Infanteriebegleitbatterie* (artillery battery)
ICM	improved conventional munition
IGB	*Infanteriegeschützbatterie* (specialized assault artillery battery)
IKA	*Infanteriebekämpfungsgruppe* (infantry assault group)

J

JAAFAR	Joint Army and Air Force Adjustment Regulation
JAGOS	Joint Air-Ground Operations System
JFACC	Joint Forces Air Component Commander
JOC	joint operations center

K

KTK	*Kampftruppenkommandeur* (frontline commander)
KTO	Kuwait Theater of Operations

L

LSK	*Luftstreitkräfte* (German Air Service)
LZ	landing zone

M

MACV	Military Assistance Command, Vietnam
MAP	master air plan
MEDEVAC	medical evacuation

MLR	main line of resistance
MLRS	multiple launch rocket system

N

NATO	North Atlantic Treaty Organization
NCO	noncommissioned officer
NTC	National Training Center
NVA	North Vietnamese Army

O

OIF	Operation IRAQI FREEDOM
OP	observation post

P

PGM	precision guided munition
prep	preparatory

R

RAF	Royal Air Force
RCT	regimental combat team
recon	reconnaissance
regt	regiment
reinf	reinforcing
RFC	Royal Flying Corps
RIF	reduction in force
ROAD	Reorganization Objective Army Division
ROMAD	radio operator, maintainer, and driver
(old name)	recon, observe, mark, and destroy (new name)
rte	route

S

SAC	Strategic Air Command
SAM	surface-to-air missile
SECDEF	Secretary of Defense
SF	Special Forces
SOF	special operations forces
spt	support

T

TAC	Tactical Air Command
TACAF	Tactical Air Force

TACC	tactical air control center
TACFIRE	Tactical Fire Direction System
TACP	tactical air control party
TADC	tactical air direction center
TAF	tactical air force
TASE	Tactical Air Support Element
TF	task force
TOE	table of organization and equipment
TOW	tube-fired, optically-tracked, wire guided
TRADOC	US Army Training and Doctrine Command
TRICAP	triple capability

U

UN	United Nations
USAAF	United States Army Air Force
USAF	United States Air Force

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