TACTICAL DEEP OPERATIONS: PLANNING TO MANEUVER THE AH-64

A MONOGRAPH
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ABSTRACT

TACTICAL DEEP OPERATIONS: PLANNING TO MANEUVER THE AH-64 by Major Wayne A. Parks, Aviation, USA, pages

This monograph examines the planning methodology of US Army Corps for employment of the AH-64 Apache attack helicopter in tactical deep operations. It takes an analytical approach to define the deep environment in which the AH-64 must operate. Planning techniques for deep operations tactics are found in a handbook produced at Fort Leavenworth in 1990 and some corps standing operating procedures. These techniques place emphasis on a targeting methodology called D3A (decide, detect, deliver, assess). This methodology provides sufficient information for engagement of enemy targets. However, the AH-64 requires information on many areas of the deep battlefield that will provide freedom of movement through or near enemy forces to gain positional advantage for delivery of their fires. This paper will provide a piece of the analysis necessary to reassess the planning methodology and ensure a more thorough technique.

The first part of the monograph informs the reader about the theories that have defined tactical deep operations. These theories were developed and well documented in Russia between World War I and World War II. Later, the United States identified their own need to produce deep operations doctrine. Deep operations principles are now an integral part of the overall tactical concepts in US Army doctrine. Parts two through four describe the environmental conditions in which the AH-64 operates during tactical deep operations. These conditions include the AH-64, the command and control structure, and the potential enemy force. The AH-64 possesses certain capabilities and vulnerablities as a combat system. These are described as they relate to the actual equipment design, the average pilot and co-pilot/gunner, and the terrain. The unit structure is described along with unit employment in deep operations and unit command and control. An enemy force is described that poses a threat to the AH-64 and that is the targeted objective for the AH-64 in tactical deep operations. This threat model is capabilities based and is, more or less, present worldwide.

The study concludes that the best way to plan for the use of the attack helicopter in the tactical deep operation for the US Army is as an offensive maneuver force. This force is a combat force that moves across the battlefield for positional advantage to deliver fires. The monograph proposes a planning methodology that emphasizes maneuver as much as fires in tactical deep operations.

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Introduction

United States (US) Army tactical deep operations are critical activities within the battlefield framework. Deep operations require close synchronization of many battlefield systems in order to attack the enemy effectively. This close synchronization demands a planning methodology that is suitable at the proper level of command for each system. The AH-64 is a US Army attack helicopter that is a primary attack system for tactical deep operations. Planning for its success is a central concern for corps and division commanders and staffs. The principal question that the author of this monograph will attempt to answer is: What is the best way for the US Army to plan for the use of the attack helicopter in the tactical deep operation?

Contemporary literature within the US Army refers to the AH-64 as a maneuver asset. This would lead one to think that the planning methodology by corps and division staffs for employment of AH-64's is centered on the principles of maneuver. The current planning methodology for corps and division deep attacks, however, concentrate on a targeting methodology called D3A (decide, detect, deliver, assess).[1] The Field Artillery Center developed this planning technique for indirect fires systems.[2] The primary emphasis in planning for an indirect fire system is *effects on the enemy force*. Maneuver planning requires a heavy emphasis on movement to gain positional advantage, usually in order to deliver--or threaten delivery of--direct and indirect fires.[3] Generally, the most difficult aspect of maneuver is movement through or near enemy forces to gain this positional advantage. The D3A methodology only does a good job in locating and identifying the target to provide an engagement area to the attack helicopter. Results of this study will help determine if the D3A targeting methodology provides sufficient information for the employment of AH-64's on the corps tactical deep battlefield.

This monograph will take an analytical approach to define the deep environment in which the AH-64 must operate. The paper consists of four parts. Each part will analyze the components of the system that make up the successful employment of the AH-64 in the deep operations portion of today's battlefield. Part I informs the reader about the theories that have defined tactical deep operations. Emphasis is placed on explaining how current doctrine for deep operations has evolved. The reader's understanding of the current doctrine and its evolution is paramount in understanding the overall hypothesis and methodology of this monograph.

Part II through IV will describe the environmental conditions in which the AH-64 operates during tactical deep operations. Part II describes the AH-64's capabilities and vulnerabilities in relation to the actual equipment design, the human factor as represented by the average pilot and co-pilot/gunner, and the terrain. Part III shows what the unit consists of and how the command and control is organized. This part describes how the structure of the organization defines the current role of the attack helicopter in doctrine. Part IV describes the capabilities and vulnerabilities of a potential enemy force with emphasis placed on the particular threats posed against the AH-64.

The conclusion summarizes the evidence and links the critical information in order to answer the primary research question. The answer to this question will be based on a detailed analysis of as many factors as possible affecting the AH-64 in the deep battle. [4]

Present doctrine does not address planning techniques for deep operations tactics. A handbook produced at Fort Leavenworth in 1990 is the most recent document to describe the tactics, techniques, and procedures (TTP) for planning and executing deep operations.[5] Corps and division planners need a common published planning doctrine that encompasses all aspects of the deep operations theory. The handbook mentioned above is a good starting point but needs to be updated and produced as US Army doctrine. This paper will provide a piece of the analysis necessary to reassess the planning methodology and ensure a more thorough technique.

The monograph will take into account as many factors as possible that influence the successful employment of AH-64's on the next battlefield.[6] The author must place some limits on the scope of this short forty page monograph in order to draw a logical conclusion from the facts presented. The paper will limit its analysis to the Corps Attack Helicopter Battalion. Division Attack Helicopter Battalions are similar in organization, equipment, and personnel. Other limitations will be addressed throughout the paper as necessary to ensure that the reader understands the limits of this study. The importance of this monograph is not semantic. Rather it is intended to provide some insight towards successful planning and execution of AH-64 missions in tactical deep operations. The theory resulting from this monograph may never be tested within the actual environment defined here but it should assist current and future planners of tactical deep operations over the next five years.

Deep Operations Theory

Current US Army doctrine defines deep operations as attacking enemy forces and functions beyond the close battle by combining the elements of firepower, maneuver, and leadership.[7] This monograph will focus on the employment of firepower and maneuver. Leadership is assumed to be the determining factor in deciding how to use and achieve effective employment of these elements to some end. The doctrine goes on to describe as the purpose of deep operations, to "facilitate overall mission success and enhance protection of the force."[8] These effects are achieved principally by destroying, delaying, disrupting, or diverting enemy combat power. Deep operations are conducted on an expanded battlefield, in space and time, as determined by friendly capabilities.

This section of the monograph will describe for the reader how the concepts of deep operations were developed in relation to its contemporary definition. The monograph will concentrate on the development of deep operations theory in Russia and then later in the United States Army.

Even though the United States did not produce a theorist on land warfare to rank with Clausewitz and Jomini, they had military strategists who applied sophisticated operational concepts during the American Civil War. Cavalry, on both sides, was famous for conducting wide sweeping envelopments into the enemy's rear to spread confusion, interdict logistics and lines of communications. In 1862, J.E.B. Stuart, Nathan Bedford Forrest, and John Hunt Morgan conducted raids on Union communications and logistics with dramatic effects.[9] In mid-June of 1862, J.E.B. Stuart was able to destroy $7,000,000 worth of Union stores in a deep raid that encircled General McClellan's forces.[10] Deep raids were also used to engage enemy forces in an economy of force role to prohibit their use in the main engagements.

Deep raiding tactics were not lost on the Union generals. On 4 July 1863, the 8th Pennsylvania Cavalry was ordered to attack between the Confederate Army and the Potomac. They interdicted and destroyed the Confederate trains sent over the mountains west of Gettysburg to Williamsport.[11] As part of this same action, another example of deep attacks by the Union Cavalry occurred. As the Confederates were consolidated at Williamsport, the Union Cavalry conducted deep penetrating attacks that destroyed Lee's only remaining bridge in his rear.[12] These actions successfully disrupted the Confederate withdrawal.

In 1876, the Russians conducted a major exercise modeled on the raids of the American Civil War and their own use of the Cossacks.[13] The Russian Empire conducted deep penetration operations with the Cossacks as early as the eighteenth century.[14] They were well suited for independent operations in the enemy's rear. The Russian's studied the American cavalry raids and incorporated this tactic into their own military actions. The wide expanses of the Russian plains and the "...far more pronounced 'material element' in modern war..."[15] led the Russians to advocate the employment of cavalry in this manner. By using the concept of an 'American raid'(amerikanskiy reyd)[16], the Russians launched a cavalry force as deep as 150 kilometers during the 1876 maneuvers. The Russians' concluded that it was hard to counter this technique of raiding deep into the enemy's rear.

The most prominent period for the Russians' development of deep operation theory came between World War I and World War II. Marshal Tukhachevskiy was one of the great military theorists in Russian history. His military thought, during this period, stemmed from the new technological advances in the world. He teamed up with Viktor Triandafillov to extend beyond previous theories about deep operations. Tukhachevskiy employed tactics, strategy, and war strategy as three levels of war.[17] These translate essentially into what we now know as tactical, operational, and strategic levels of war. He used these constructs to develop a theory of an expanding battlefield where the technological advances of the time could be used to best effect.

"Thinking Deeper" principally came from Tukhachevskiy's and Triandafillov's maneuver-based concepts combining mobility and firepower.[18] Tanks provided the protected mobility that was necessary to maneuver at tactical depths. This, combined with the extended ranges of artillery systems, led to the deep battle concepts presented in the 1929 Russian Field Service Regulation, PU-29. Infantry forces were not mechanized yet. This limited the ability to use the "all-arms" approach in deep battle.[19] Eventually, this was corrected by placing infantry in troop carriers to keep pace with armor. "Chapters 5 and 7 of PU-36 [the 1936 Field Service Regulation] lay overwhelming emphasis on infantry battalion, tank and artillery commanders working out co-operation on the ground."[20] This opened up greater possibilities of larger scale maneuver for Tukhachevskiy's and Triandafillov's theories.

The Russian tactics for deep operations centered on the methods of envelopment and penetration. The Russians' favored technique was the turning movement. However, Tukhachevskiy saw the need to parallel the enemy's flank as deep as possible and turn in across the enemy's rear in full envelopment. This was done to destroy the now encircled force. A straight penetration was necessary if the enemy did not present an open flank. This penetration had a similar effect as the envelopment, by creating a flank and diverting enemy combat power. Once the attacking force reached sufficient depth, a follow-on force would turn in the direction necessary to destroy the enemy and block the main force's axis of withdrawal. This tactic required the great speed offered by mechanized forces and the concentrated firepower that artillery and aviation could provide.

Tukhachevskiy used the principle of simultaneity to explain expanding the battlefield in depth and time. It is around this term that Tukhachevskiy developed his operational and tactical thinking. This passage from PU-36 defines the term simultaneity best:

> **The resources of modern defence technology enable one to deliver simultaneous strikes on the enemy tactical layout over the entire depth of his dispositions. There are now enhanced possibilities of rapid regrouping, of sudden turning movements, and of seizing the enemy's rear areas and thus getting astride his axis of withdrawal. In an attack, the enemy should be surrounded and completely destroyed.**[21]

Tukhachevskiy's idea for deep operations was directed at neutralization of the enemy's tactical defense through its entire depth. This meant three things to Tukhachevskiy. First, the destruction of the enemy's artillery and machine-guns to prevent them from obstructing attacking infantry and tanks before they reach their desired depth. Second, the disruption of the enemy's command and control systems. Third, the delay or isolation of the enemy's reserve in order to destroy them in detail.[22]

These effects would provide the attacking forces the protection necessary to achieve the complete destruction of the enemy.

Tukhachevskiy's ideas were embodied in the 1936 Field Service Regulations. However, the most significant changes in Russian thought came after 1938. Stalin had Tukhachevskiy and five of his six most capable associates shot. After this, Russian deep operations theory was replaced by other concepts until 1942. In early 1942, the Russian Supreme Headquarters (Stavka) realized that drastic changes were needed in order to regain the initiative from the Germans. They reincarnated Tukhachevskiy's deep operations theories and reorganized for combat in the manner that Tukhachevskiy and Triandafillov had envisioned.[23]

The Soviet Union retained these basic principles of deep operations after World War II. There were three major differences from the doctrine existing at the end of the Cold War and that of Tukhachevskiy. All were associated with technology. First, the mobility and firepower of post-war weapon systems expanded the battlefield significantly. Tukhachevskiy envisioned this, but his thoughts were tempered by the technology available to him. Second, the advent of tactical nuclear weapons provided the breakthrough capability that Tukhachevskiy desired. Third, Soviet tactical forces were granted less freedom of action than Tukhachevskiy suggested. This is attributed to the capabilities of long range C3I systems available to them that allowed direct control of a company group by an army commander.[24] These technological advances and the Soviet political beliefs focused their deep operations doctrine firmly at the operational level.

After the war in Vietnam, General William E. DePuy took over a new US Army Training and Doctrine Command (TRADOC) and refocused the US Army from Vietnam to Europe and the continued threat from the Warsaw Pact. General DePuy needed to turn an all volunteer army into a professional ground force that could defeat a much larger and more prepared foe in Europe. His ideas came from a combination of his personal experiences, largely in World War II; the significant challenge presented by the Soviet Union's overwhelming combat power; and the 1973 Arab-Israeli war. With these ideas, General DePuy produced the 1976 field manual for army operations, FM 100-5. General DePuy's doctrine, called Active Defense, favored a defense mixing maneuver, firepower, and synchronization to concentrate combat power on the lead echelons of the Warsaw Pact forces. The discussions about this doctrine, coupled with the emerging development of the Army's "Big Five" procurement priorities, were at the heart of the deep operations concepts that would follow.[25]

General Donn A. Starry took over from General DePuy as the TRADOC Commander in 1977. He developed the concepts for fighting a deep battle that would prevail as the deep operations doctrine in the US Army. These concepts came from his experience as the V Corps Commander in Europe and his earlier involvement in developing the 1976 FM 100-5. General Starry's V Corps experience presented him the problem of dealing with the Soviet second echelon beyond the main battle front. He believed that while the Active Defense dealt suitably with the Soviet first tactical echelon, it did not address sufficiently the numerically superior follow-on echelons. General Starry set his combat development staff to work on this problem. From this came the idea of "seeing deep", beyond the enemy's first echelon, and attacking to disrupt his second. The army could not see or fire deep enough on this expanded battlefield to fight the deep battle alone. This led to discussions and agreements between the Army and Air Force on interdicting the follow-on echelons before they could affect the near battle. This joint approach to battle would be known as AirLand Battle. This concept required extensive coordination between intelligence, maneuver, fire support systems, and the Air Force. The purpose of this integrated battle was to delay the follow-on echelons and open the window for offensive action and maneuver.

In 1980, General Starry tasked LTG William R. Richardson, the new commander of the Combined Arms Center at Fort Leavenworth, to write an FM 100-5 to replace the 1976 version. LTG Richardson and his doctrine writers saw the potential of tactical deep operations. The early development of the M1 tank, M2/3 infantry fighting vehicle, and AH-64 attack helicopter provided US Army commanders with the vehicles necessary to maneuver deep into the enemy's formation and attack their follow-on forces with direct fires.[26] Simultaneously, the army started to see improvements in the range and accuracy of indirect fire systems. When combined with the maneuver systems, they provided commanders the ability to affect enemy forces that were not currently engaged in the fight. As the nineteen eighties progressed, vast improvements in technology provided tactical commanders a counter to the Soviet Union's fast paced, deep objective oriented, maneuver warfare concepts.[27] Armored vehicles, attack helicopters, long range artillery, and missiles could provide the US Army with a combination of lethal fires to wrest the initiative from the enemy (Warsaw Pact).

The US Army doctrinal thought throughout the 1980's brought on many discussions and studies concerning deep operations. In 1989, the end of the Cold War caused the US military to begin evaluating their structure and doctrine once more as a result of new threat assessments. The US Army retained the AirLand Battle concepts to carry them into the 1990-1991 Gulf War. There, instead of establishing a defense in central Europe, the US Army found itself in an offensive maneuver across the great expanses of desert. They would get a chance to test the deep battle concepts, but in an offensive mode. The idea of attacking the enemy deep to disrupt, delay, or destroy their forces, logistics, or communications was still valid. The US Army quickly expanded the battlefield and then attacked deep into the Iraqi defenses. These deep operations were intended to pursue the Iraqi Army to slow their withdrawal and attack the Republican Guard forces to protect the main effort.[28] The deep attack remained the same whether it was intended to disrupt follow-on echelons in the defense or attack to exploit the offense.

General Frederick M. Franks, Jr., who commanded VII Corps in the Gulf War, took command of TRADOC in 1991. General Franks and TRADOC took on a challenge to match General Starry's task in the late 1970's. The US Army was required to go through an intellectual change to prepare the army for the new multi-polar world situation. A new FM 100-5 was published in 1993. John Romjue, a TRADOC Historian states, "Franks believed that deep battle, a hallmark of AirLand Battle doctrine, was moving into a new definition from the experience of the Gulf War."[29] In the 1993 manual, in a concept similar to Tukhachevskiy's, decisive deep battle would take place simultaneously throughout the depth of the battlefield rather than deep forces employed only to shape the close battle.[30] The 1993 doctrine placed a greater emphasis on joint coordination while emphasizing targeting and attacking the enemy together with near-real-time information. The result is the definition of deep operations shown on page 4 above in which deep operations are distinguished in terms of activity, place, and purpose.

The AH-64 Attack Helicopter

The AH-64 attack helicopter is a major component of the US Army tactical deep operation. The original helicopter was designated as the AH-64A Apache and is currently fielded throughout the US Army. A new version of the Apache, AH-64D, is now in production. This model can be configured in two different ways. The first is still known as the Apache with upgrades. The second is known as the Longbow and can be equipped with significant enhancements beyond the current Apache's. The AH-64D will be fielded completely by the year 2008, beyond the five years that this monograph addresses.[31] This section of the monograph will describe the AH-64A as the primary helicopter and will discuss the AH-64D Longbow enhancements that will play a limited roll during the next five years. In addition to equipment design, the human dimension and physical environment will be described as they relate to the capabilities and vulnerabilities of this combat system.[32]

The Apache has four principle characteristics; mobility, firepower, protection, and communications.[33] It provides the commander a day, night, and limited-visibility fighting capability across the expanded battlefield. It is most noted for its wide array of firepower options. The Apache receives its primary protection and combat survivability from on-board electronic warfare countermeasures. The AH-64 is equipped with a communications suite for command and control of the unit in which it is assigned.

The US Army designed the helicopter around the notion of mobility on the battlefield.[34] The Apache achieves its mobility through airspeed, range, endurance, and visionics. Airspeed will vary with mission profiles. The standard rule of thumb is that, the higher it flies, the faster it can go. This is for safety reasons. With a reduction in altitude, the airspeed must be decreased in order to use the terrain for protection. The normal cruise airspeed in a deep attack is 100-120 knots at 100 feet.

The combat radius of the Apache is approximately 150 kilometers from take-off point to the objective. It can also be configured with an external 230-gallon fuel tank to extend its range on the deep attack. The combat radius with one external fuel tank installed is approximately 300 kilometers. However, this reduces the weapons load. The Apache's endurance, in relation to time, is also a measure of mobility. Without the external fuel tank installed, endurance is approximately 2 hours and 20 minutes before the Apache must be refueled. If the crew decides to land the helicopter, they can shut off the engines and operate on the auxilary power unit (APU). The APU uses approximately 20 gallons per hour while the engines use approximately 150 gallons per hour in a typical mission profile. The APU is capable of providing power to the primary mission equipment.

The pilot night vision system (PNVS) uses forward looking infrared (FLIR) to provide the pilot with a method of seeing under zero illumination conditions. This permits missions at night at near normal flight conditions. The PNVS can be viewed through the integrated helmet and display sight system (IHADDS). The pilot uses a helmet display unit (HDU) to see through an electro-optical monocular display which provides a composite video of the environment around the aircraft. The PNVS is positioned on the front of the helicopter approximately ten feet in front of and three feet below the pilot. The monocular display allows both aided and unaided viewing simultaneously. This system places a heavy workload on the pilot during normal mission profiles.

Some of the problems associated with the PNVS are that it only provides the pilot with a monocular view and it is displaced from the pilot's physical line of sight. This gives the pilot conflicting parallax information while moving or at a hover. The PNVS also does not track the roll axis of the pilot's head, which can cause vertigo over extended periods of time *under the system*. The FLIR can enter a period of infrared (IR) crossover where the environment and manmade objects all emit the same amount of temperature. This usually happens near dawn, at dusk, under overcast skies, or in rainy weather.[35] The pilot can use the integrated symbology provided on his HDU to overcome the lack of visual acuity. The crew must increase their altitude in order to maintain safe flight under all of these conditions.

The Apache is configured with a significant amount of firepower. Its weapon systems can be fired in a direct or indirect mode. The helicopter combines weapon systems and visionics for maximum effectiveness. The weapon systems consist of the point target weapon system (PTWS), area weapon system (AWS), and aerial rocket control system (ARCS). The visionics associated with the weapon systems consist of the target and acquisition designation system (TADS).

The PTWS fires the hellfire missile. This is the primary weapon system on the Apache. The normal load of hellfires during deep operations is 16 missiles. Hellfire is a laser guided air-to-surface missile that was developed as a precision attack weapon against armor. The missile was intended to be effective against tanks, bunkers, and structures. Experience from the Gulf War shows that the hellfire is effective against almost all land-based systems on the contemporary battlefield. The hellfire has a maximum range of 8000 meters and a minimum range of 500 meters.

There are two types of missile engagements, autonomous and remote. During an autonomous engagement, a single AH-64 fires the missile and also provides the laser energy for missile guidance. During a remote engagement, one AH-64 fires the missile and the laser designation is provided by another. This is an indirect engagement that allows the helicopter firing the missile to remain masked. In remote engagements the designator can be offset up to 60 degrees from the gun target line of the firing helicopter. The designator must also stay outside of a $\pm$ 30 degree safety fan from the firing helicopter.

Although the Hellfire missile is very reliable, it has some shortcomings that were identified during the Gulf War. First, it produces smoke when fired. This signature has been reduced in later models of the missile. Second, the laser that guides the missile has been found to have an obscurant/backscatter problem. This is caused by particles in the air that reflect the laser and make the missile steer toward the wrong designation point. Third, low cloud ceilings can cause the missile to break lock after acquisition. The hellfire has steep climb and terminal dive angles in order to impact armored targets at the weakest point of their protection, the top of the turret. At extended ranges, the pilot must steer the missile by delaying the laser designation to keep it below the cloud ceiling. This is not a problem as much as it is a limitation to missile employment.

The AWS is a 30mm cannon used primarily against lightly armored targets and for self protection. It fires a high-explosive, dual-purpose round at a rate of 600-650 rounds per minute. The maximum range of the AWS is 4,000 meters, with a maximum effective range of 1500-1700 meters. The AH-64 carries a capacity of 1200 rounds in a deep attack mission profile. There are no significant problems with the AWS except for a low muzzle velocity. This extends the exposure time of the helicopter when firing at long ranges. This usually means that the crew will have to close to within 2,000 meters for effective engagements.

The ARCS consists primarily of a rocket control panel and the M261 lightweight launcher. The launcher carries a combat load of 19 Hydra 70mm (2.75 inch) rockets. Each rocket can be configured with numerous types of warheads and fuzes. The warhead of choice for the deep operation is the M261 high explosive multipurpose submunition (MPSM). The MPSM provides improved lethal effectiveness against area targets such as light armor, wheeled vehicles, material, and personnel. It contains nine submunitions with shaped charges for armor penetration. The submunition is internally scored to optimize fragmentation against personnel and materiel. The Apache can carry a maximum load of 76 rockets and has a maximum range of 9,000 meters. The most effective range for the Hydra 70 is 3,000 to 4,000 meters.

The rocket is very effective when fired accurately. There are three categories of misses that can degrade the effectiveness of the rocket fire. These are dispersion, range errors, and azimuth errors. Dispersion results from pointing the rocket pods incorrectly, aircraft motion, or rotor downwash inconsistencies. Increased footprints at impact are produced with increased range due to angular errors. The crew can lessen dispersion by reducing airframe motions (pilot induced and downwash induced errors).[36]

A major part of the Apache's weapon system is the TADS. This system is mounted on the nose of the helicopter and is the primary system for acquiring targets and firing the weapons. It has three sensors; forward looking infrared (FLIR), day television (DTV), and direct-view optics (DVO). The DTV and DVO are used for daytime engagements while the FLIR is used primarily at night. For survivability of the Apache, most deep operations missions are conducted at night. This means that the crew will use the FLIR during these missions. The FLIR can acquire and designate targets at the same maximum ranges as the weapons systems. However, it is limited to less than 1,500 meters in order to positively identify these same targets.

The manufacturers of the Apache built in survivability measures to protect the aircraft and crew. These include passive and active countermeasures against electro-optical systems. Protection and survivability also include ballistic tolerance of the airframe and redundancy of critical systems.

A helicopter cannot be weighted down with heavy armor. The design of the Apache provides active electronic systems to protect it from its primary threat, electronically guided and IR air defense systems. These electronic countermeasures will defeat most radar systems encountered in a deep operation. An automatic radar jammer that analyzes and jams various incoming radar signals is mounted on the nose of the helicopter. An IR jammer is mounted on top of the helicopter near the rotor blades. This system jams a variety of missiles by producing a false IR signature away from the helicopter. A jam program card is inserted into the jammer armed with a specific jam program number. This program number is only capable of jamming a certain number of threats within a particular operating band in which enemy IR missiles operate. Maintenance personnel must set this program number prior to takeoff. The Apache also has a chaff and flare dispenser mounted on the tail of the helicopter. Chaff is used as a countermeasure against radar guided weapons systems. The flares are used against IR missiles to decoy them away from the helicopter for detonation.

The passive systems include a radar signal detector, engine exhaust heat suppression, and IR absorbing paint. The radar signal detector monitors the pulse wave radio frequency (RF) environment for potential threats to the helicopter, providing real-time warning to the aircrew. It displays the threat on the indicator in a relative bearing from the helicopter. Threat information is reported to the crew in synthetic voice form over the aircraft inter-communication system (ICS).[37] The threats that it can detect are limited to what is available in the most current software controlled threat library. Maintenance personnel must install this software. Engine exhaust heat suppressers are installed at the rear of the engine exhaust to reduce the heat signature. It reduces heat signature to counter IR missiles. The infrared absorbing paint on the fuselage is also intended to counter the IR threat.

The Apache was designed for ballistic tolerance against small caliber projectiles. This is accomplished through ballistically tolerant material and redundant systems that are critical to flight. The crew compartment is made of lightweight kevlar and a transparent acrylic blast barrier between cockpits to protect the crew from 12.7mm armor-piercing rounds. Sections of the flight controls are ballistically tolerant against 12.7mm direct hits. Additional protection is provided by redundant flight control systems for the main and tail rotors. The main rotor blades are tolerant to 23mm cannon hits. The main transmission can sustain ballistic damage and continue to operate for one hour. Protection of these critical systems and the crew station allows the Apache to survive most attacks by ground infantry and some armor and anti-aircraft artillery.

Apache avionics consist of communications, navigation, identification, and flight equipment. The communications package includes; an ICS, VHF AM-FM radio, UHF AM radio, and VHF FM Single Channel Ground and Airborne Radio Set (SINCGARS). The ICS integrates the capability for crew communication, radio communication, and radio monitoring. The radios permit two-way communications with other communication equipment on the battlefield. Both VHF radios can be secured with the addition of encrypted communications security equipment. The UHF and SINCGARS radios are capable of frequency hopping operations. This limits the ability of the enemy to jam the transmissions from these radios. Maximum range for communications on these radios is approximately 50 kilometers line of sight. The Apache also incorporates a transponder for identification of friend or foe (IFF). This receiver/transmitter provides automatic radar identification to all suitably equipped air or ground systems. It can also transmit position identification and emergency signals for search and rescue of the helicopter and crew.

The navigation equipment integrates several systems to locate the current position of the helicopter, provide course information, and provide data for storing target locations. The Doppler navigation system (DNS) provides dead-reckoning navigation by measuring the velocity of the helicopter across the ground using radar. It is completely self-contained and requires no ground-based aids. The Global Positioning System (GPS) provides similar information, but with greater accuracy. It receives data from overhead satellites to determine the present position of the helicopter. The Heading and Attitude Reference System (HARS) is an inertial reference system. It combines data from the navigation systems with its inertial data to enhance position accuracy. A radar altimeter provides instantaneous altitude information to aid in maintaining the aircraft at a certain height over the ground. Through integration of these navigation systems and the radar altimeter, the Apache can accurately navigate NOE and engage targets from maximum standoff range.

AH-64D Longbow Apache improves the original design of the Apache to *see the battlefield* and shoot more effectively. It has been described as a "quantum leap forward" that "will be unmatched in reconnaissance, attack, and other critical Army missions."[38] Assessments rate it at 28 times more effective than the AH-64A Apache.[39] The Longbow offers advantages in real-time situation awareness, joint and combined arms integration, and increased lethality while engaging the enemy. It has a laser warning receiver to indicate enemy laser detection or designation.

The Longbow's increased firepower comes from three systems. First, is the fire control radar (FCR). The FCR is mounted above the main rotor and provides information to the aircraft systems for engaging targets. It will detect, classify, prioritize, and engage targets without the crew visually acquiring them. This allows engagements in extremely poor visibility and in an otherwise obscured battlefield. The FCR will not identify friend or foe. Second, is the radar frequency inferometer (RFI) mounted below the FCR. The RFI will detect and identify radars and display this information with the FCR for targeting. It is a long-range passive information system.

Third, are the weapon systems that can be mounted on the Longbow's wing pylons. The Longbow configuration adds the radar frequency (RF) Hellfire, fire and forget missiles, and air-to-air missiles. The RF Hellfire missile receives data from the RFI and FCR to steer it accurately onto a target. The air-to-air missile is an aerial version of the Stinger missile. Longbow crews, using the appropriate weapons symbology and data from the RFI and FCR, can engage other aircraft from the air. The Longbow's engagement systems reduce target acquisition time and engagement inside threat engagement timelines.[40]

Situation awareness and battlefield integration are provided by; an improved data modem (IDM), an aviation mission planning station (AMPS), and a data transfer module (DTM). The RFI and FCR are integrated into an information network consisting of the above components. This information network receives, processes, and distributes data for friendly and enemy situations. AMPS is not part of the helicopter, but allows the unit and crew to develop planning information for transfer into the DTM. The DTM can quickly transfer mission data and initialize the aircraft systems. The DTM retains the mission information and can be downloaded to the AMPS at the completion of the mission. The IDM allows the crew to transfer information between helicopters or to a ground control station. This device is tri-service and is backward compatible with the AH-58D airborne target handover system (ATHS) and TACFIRE.[41]

Human and environmental elements can affect the performance of the crew in a normal deep operations mission profile. The human factors include training proficiency and aeromedical conditions of the crews. The environmental factors include weather and terrain. These factors enhance the capabilities and magnify the vulnerabilities of the AH-64.

AH-64 pilots and crews undergo intense training in order to safely fly the helicopter and employ the weapon systems at night in deep operations. However, these pilots and crews are not always 100% trained for combat. An average crew must fly the helicopter *under the system* approximately five hours a week to maintain proficiency for combat conditions. The capability of the crew is degraded if this cannot be met.

Gunnery skills are an important element of training. Gunnery training and qualification are conducted in a very demanding environment. A recent study by the United States Army Aviation Center (USAAVNC) presented live fire data from United States Army Europe (USAREUR) attack helicopter gunnery ranges.[42] Table 1 shows the percentage of qualified engagements for the PTWS, AWS, and ARCS. Percentages are calculated on 1800 total engagements for each weapon system. Data from Desert Storm shows that the percentage of hits by the Apache PTWS was 63.5%.[43]

Table 1. Apache live fire data

Weapon	Range	Standard	Qualified
PTWS	2000-4500 meters	Target Hit	86%
AWS	700-1400 meters	Target Hit	70%
ARCS	2500-6200 meters	Target Neutralization*	45%

*Target Neutralization is defined as placing enough munitions within a box on the ground to produce 10% or more casualities.[44]

The AH-64 crew can be affected by psychological and physiological factors. These factors include fatigue, vertigo, visual limits, and toxic hazards. The normal mission profile for deep operations causes acute fatigue that produces mental and physical weariness. After several missions over the course of a campaign, crews can suffer chronic fatigue. This condition is extremely dangerous and can result from as few as three to five successive nights of deep operations. As mentioned above, the night vision systems used with the AH-64 affect the crew's visual perception. Night vision systems handicap the crew's visual acuity, field-of-view, color vision, and depth perception. It also causes ocular rivalry, adds weight to the crewmember's head, and induces stress from disrupted circadian rhythms inherent in nighttime operations. These degraded visual perceptions combined with stress and fatigue predisposes crews for visual illusions and errors.[45]

The weather and terrain have varying effects on the AH-64 and crew. Weather conditions with the most impact on flight are ambient light and obscurants. As described above, the AH-64 has night vision systems to assist in overcoming these conditions for unobstructed vision. The obscurants require the crew to reduce airspeed and maneuver closer to the enemy for successful engagements. The helicopter was originally designed as an aircraft. However, the US Army has developed the helicopter as a combat system that must operate in the ground environment.[46] It utilizes the advantages presented from terrain yet overcomes the limitations of that terrain. Terrain relief provides cover and concealment for the helicopter. This allows undetected movement into position to attack the enemy and cover from enemy fire. The AH-64 is able to overcome most obstacles presented by terrain. When flying close to the ground, these obstacles can be a hazard to flight. This requires intense concentration on the part of the crew during deep operations.

The AH-64 is made up of two components, helicopter and crew. It is a fully automated helicopter that attempts to reduce the workload of the pilot and gunner. However, its sophistication can sometimes overload the crew in a high to mid-intensity threat environment. As described above, the AH-64 is extremely lethal and highly mobile. However, its performance is limited by many factors present on the battlefield. The built-in protection measures and communications are the most notable weaknesses. The AH-64 operates in the ground regime.[47] This increases the stress on the crew and subsequent performance of the helicopter flight and weapon systems.

The AH-64 Attack Helicopter Unit

The attack helicopter battalion (ATKHB) is the principle organization employed in deep operations. This unit can be part of the division or corps aviation brigade. Currently, the aviation units are undergoing structural changes known as the Aviation Restructure Initiative (ARI). The intermediate changes are almost complete and the objective unit will be fielded within the five years that this monograph addresses.

The aviation brigade is a complicated organization that commands and controls aviation units in maneuver, combat support, and combat service support operations simultaneously. This is accomplished throughout the depth and width of the battlefield. This part of the monograph will describe these units, their employment in deep operations, and the way they are commanded and controlled.[48]

Corps aviation is currently fielding an attack helicopter regiment (ATKHR) headquarters under ARI to command the ATKHB's during combat operations. This command and control headquarters provides the aviation brigade commander a maneuver commander to employ the ATKHB's across the battlefield. A survey of doctrinal publications did not produce concepts for employment of the ATKHR in deep operations. Further discussion of this headquarters will be presented in the conclusion as it should apply to the overall planning process and execution of corps tactical deep operations.

The ATKHB conducts offensive operations to destroy enemy forces using fire, maneuver, and shock effect. The ATKHB also conducts reconnaissance, security, and defensive operations. The effects that the ATKHB seeks to inflict on the enemy are destruction, attrition, disruption, or delay. This unit operates as a member of the combined arms team. It does not have to be located physically with friendly forces, but its actions must be synchronized with their scheme of maneuver. The main focus of the ATKHB is to move rapidly across the battlefield to deliver massed fires accurately on the enemy.

The agility and versatility of the ATKHB are its major strengths. The speed with which it can traverse the battlefield provides the corps commander a highly mobile and flexible force. Agility is also achieved since helicopters are not limited by terrain. The ATKHB's primary mission is destruction of enemy armor and mechanized forces. Its wide array of firepower allows it to engage and destroy hard points, personnel, and many other types of enemy targets. During the Gulf War, an ATKHB fired on and destroyed a bridge that the Air Force could not attack due to weather.[49] Under differing battlefield conditions, the ATKHB has the capability to conduct many missions to include intelligence gathering and indirect fires. This kind of versatility is attributed largely to the capabilities of the technologically advanced AH-64.

The corps aviation brigade normally consists of three ATKHB's. Each of these battalions is organized into three attack helicopter companies (ATKHC), one headquarters and headquarters company, and one aviation unit maintenance company. The ATKHC is organized with eight AH-64 attack helicopters. The company commander will task organize these helicopters into two platoons according to METT-T. The force structure was designed for three helicopters for the aeroscout platoon and five helicopters for the attack platoon. The battalion commander may also desire to task organize the battalion into one aeroscout company team and two attack company teams. There are many other task organizations available to the battalion commander, but these are the standard for employment. The discussion in this monograph will use these task organizations.

Attack helicopters are normally employed as a battalion. The ATKHB has sufficient combat power to engage a total of 384 enemy targets when all 24 AH-64's are loaded with 16 Hellfire missiles. The ATKHB must be under the command and control of at least a battalion commander to conduct independent operations deep into enemy territory. The analysis that follows will take these two factors into consideration and limit the discussion to the employment of an ATKHB in deep operations.

ATKHB's conduct attacks or raids when performing deep operations for the corps. FM 1-112 defines deep operations as, "activities directed against enemy forces that currently are not engaged but that could influence division or corps close operations within the next 24 to 72 hours. Deep attacks by corps ATKHB's help the corps commander to shape the battlefield and set the terms for close operations."[50] The manual goes on to state that deep operations are conducted during friendly offensive and defensive operations. There are five phases to conducting deep operations for the ATKHB. These phases are; planning, movement to the objective, actions on the objective, egress from the objective, and restoration. The restoration phase will not be addressed in this monograph.

The ATKHB begins the attack by moving from a forward assembly area (FAA), penetrating the forward line of troops (FLOT), and moving to a release point prior to the objective. The FAA is the last place that the battalion receives detailed updates on the enemy, friendly, and overall battlefield situation. The movement normally is conducted employing traveling overwatch while making final coordination through radio communications for a forward passage of lines and penetration of the FLOT. Penetration can be conducted by stealth or fires. Stealth is used when the enemy situation presents a seam or flank to penetrate. This method creates the best opportunity for surprise. Penetration by fires is required when the enemy positions are concentrated across the entire front of the corps. Direct and indirect fires are combined to suppress or destroy all known enemy systems within range of the ATKHB in the penetration area. These fires must begin prior to the first helicopter crossing the FLOT and end after the last helicopter departs the penetration area. The US Army commonly refers to this penetration area as the penetration box.

As the ATKHB continues moving deep into enemy territory, it becomes reliant on its own organic systems for suppression and destruction of threats to its survival. The ATKHB will continue to coordinate indirect fires with the corps as necessary. This movement is conducted at airspeeds and altitudes mentioned above until approximately ten kilometers prior to the objective area. A release point (RP) is designated and the ATKHB moves into an attack formation using the terrain for concealment and protection. The aeroscouts normally move to the front and flanks of the attack teams for reconnaissance and security. The movement phase is complete when the ATKHB reaches the objective area or makes contact with the enemy target.

As the battalion arrives at the objective area, the commander or S3 requests updates from the corps and their own aeroscouts to confirm or develop the enemy and friendly situation. Once the battalion commander fully understands the situation, he maneuvers his forces and engages the target. Remote engagements are the preferred method for attack in order to protect the battalion's combat power. However, autonomous engagements will reduce total engagement time. Most battalion commanders will use a combination of these types of engagements. The battalion normally rehearses direct fire distribution and control in the FAA. It uses indirect fires from the corps to mass effects on the enemy target in the engagement area and to protect the friendly force from being engaged. The battalion commander must continue to maneuver his forces to mass fires, protect his force, and ensure continuous command and control of the battalion. The engagement ends when the battalion expends its ammunition, allotted fuel, or the desired target effect is achieved. The battalion generally retains enough fuel and ammunition to maneuver around, or engage the enemy during egress. The ATKHB must rally its forces and move to a start point to begin egress from the objective area.

Prior to departing the objective area, the ATKHB must cover its withdrawal with direct and indirect fires. Direct fires are usually delivered by the aeroscouts and supporting fires are delivered by corps fire support assets or Air Force systems. The battalion egresses through enemy territory in the same manner as they moved to the objective area. They must request a situation update from the corps to avoid enemy positions that threaten the battalion's withdrawal and to prevent fratricide from friendly fires. During egress, the battalion commander requests reports from his company commanders on friendly and enemy battle damage assessment (BDA). He must coordinate with the corps for downed-pilot-pick-up or search-and-rescue operations. The final part of the egress phase is the rearward passage of lines. This may require the ATKHB to bypass the enemy or penetrate enemy defensive belts while coordinating with friendly forces for passage. The egress phase ends when the ATKHB arrives at the FAA to begin restoration of the unit's capabilities for future missions.

Corps tactical deep operations are planned to further accomplishment of the corps' mission. The corps' plan must be integrated into the broader framework of the echelons above corps (EAC) plan. "The [corps] deep operations concept has as its basis the operational triad of maneuver, fires and C3CM [command, control, and communications countermeasures]."[51] The corps uses the D3A targeting methodology to plan deep operations.[52] This methodology provides, "an effective method for matching the friendly force capabilities against enemy targets."[53] The D3A methodology is described here as it affects corps tactical deep operations planning.

The US Army describes the D3A methodology in this manner, "The decide, detect, deliver, and assess methodology facilitates the attack of the right target with the right asset at the right time."[54] The decide function is the first step that focuses and sets priorities for intelligence collection and fire planning. This is accomplished by conducting a mission analysis and a thorough intelligence preparation of the battlefield (IPB). The IPB is a labor intensive process and results in many products. In corps deep operations planning, the decide function uses these products to develop an attack guidance matrix (AGM). This AGM comes from identifying enemy high-value and high-payoff targets. It also includes identification of sensor and attack systems to acquire and attack the high-payoff targets (HPT).

The detect function is the next critical step in the D3A process. During this step, the G2 directs the efforts of all collection assets through a collection plan. The tasks are performed by numerous reconnaissance and surveillance units within the corps and EAC units. Primary concern in this step is the synchronization of the collection plan to focus the collection and avoid unnecessary duplication of effort. This intelligence is analyzed at the corps analysis and control element and is provided to deep operations planners for further dissemination to sensor and attack units. The detect step includes tracking of mobile targets to maintain a current target location. Detection and tracking are focused on the HPT's identified in the decide phase of the D3A process. New targets may be identified during this step and will be included as necessary to ensure successful mission accomplishment.

The next step is the deliver function of the D3A methodology. This step requires execution of the AGM to support the commander's plan when the HPT's have been located and identified. The decision to attack requires a final review of the AGM for the time of the attack, the desired effect, and the attack system to be used. As a result of these decisions, a decision must be made as to the number and type of munitions, unit to conduct the attack, and the response time of the attacking unit. These decisions are analyzed as part of the planning process using decision points and triggers for attack of the HPT's. Hasty decisions must be avoided when placing friendly personnel and high-value assets at risk during deep operations.

The final step in the D3A methodology is the assess function. The deep operations plan requires a combat assessment to determine battle damage, munition effect, and whether reattack of the HPT is necessary. This assessment may change the earlier decisions and plans of the commander and staff. This is the last step in the corps methodology for planning deep operations. This methodology is supposed to synchronize the corps' assets for conducting deep operations to affect enemy units at depth in the corps' area of operations. D3A is an effective method that provides the corps DOCC operations cell and corps subordinate units an order for surveillance and attack of enemy HPT's.

Command and control (C2) of corps deep operations uses the standard process described in FM 101-5 of planning, coordinating, directing, and controlling. The corps establishes a deep operations coordination cell (DOCC) with the main command post (CP).[55] The DOCC consists of intelligence, plans, current operations, fire support, and aviation cells. It is normally commanded by the corps artillery commander and the staff is led by the corps fire support coordinator. The DOCC also contains the air support operations center (ASOC), army airspace command and control (A2C2) cell, and the aviation brigade tactical command post (TAC CP). The DOCC focuses on deep targeting, using the D3A methodology and controls deep assets during execution of deep operations. Once it selects the target for the ATKHB to attack, it turns the plan over to the aviation brigade to complete the planning. This usually happens from 24-48 hours prior to the mission.

The corps aviation brigade TAC CP is established to plan deep operations and control the ATKHB's during execution. The TAC CP is staffed with minimum personnel so the Main CP can retain enough of a staff for coordination, direction, and control of the brigade's diverse mission task list. The workload and information management of an aviation brigade staff are nearly equal to that of a divisional G3 element.[56] The aviation brigade staff performs these duties with fewer personnel than any other brigade level staff within the corps. The limit in personnel only allows for a skeleton staff at the TAC

CP. This prohibits the aviation brigade from conducting the in-depth planning required for deep operations. The aviation brigade operates over distances equal to the corps area of operations and sometimes throughout the theater. It does not possess the equipment necessary for continuous communications with all of its units. The distances are too great for the equipment in an aviation brigade.[57]

The aviation brigade commander can command the brigade from the Main CP, TAC CP, or airborne TAC CP. An airborne TAC CP can be established in a UH-60 command and control helicopter. Most of these helicopters are in direct support of the corps and do not possess the equipment necessary to stay abreast of a deep operation. The UH-60 is also limited in the amount of personnel it can carry when configured as a TAC CP. The aviation brigade commander needs two UH-60 helicopters for adequate planning, command, and control. The commander would normally command from the ground TAC CP that is co-located with the corps DOCC. He and his staff require the manpower and communications available at the corps to adequately plan and execute deep operations.

The ATKHB normally operates three command posts. The Main and Rear CP's are located in the battalion tactical assembly area (TAA). This TAA is normally placed near the corps Main CP for protection and communications. Planning for deep operations is conducted in the ATKHB Main CP. The TAC CP is located in the FAA and provides updates to the ATKHB prior to execution of deep operations. The TAC CP can consist of ground vehicles or helicopters.

The ATKHB commander commands the battalion from a helicopter during deep operations. He may choose to use an AH-64 or a UH-60 as his command and control vehicle. The ATKHB does not have UH-60's organically assigned. The UH-60 comes from the command aviation battalion and is under operational control of the ATKHB commander. The AH-64 provides greater protection during operations, but is limited in communications. The UH-60 provides greater communications capabilities, but is severely limited in protection. The ATKHB commander normally assigns AH-64's to protect the UH-60 command and control helicopter. The ATKHB requires approximately eight frequencies for command, control, and coordination during deep operations. The battalion commander cannot monitor all of these frequencies simultaneously in the AH-64 or the standard UH-60 configuration. The UH-60 command and control helicopter provides the ability to monitor approximately five frequencies at one time. All helicopters are limited in the number of secure frequencies available for command and control.

Satellite and high frequency communications radios are available on the UH-60 command and control helicopter. The number of frequencies for these radios are limited due to other requirements within the theater. All other radios available to the ATKHB commander during deep operations are limited by line-of-site. Because of this, the corps will coordinate with the Air Force for communications through the airborne command and control center aircraft (ABCCC). However, this method is limited in the amount of frequencies designated for the corps.

The Enemy

The enemy force is the most critical part of the combat environment for the ATKHB in deep operations. The ATKHB must be able to protect its forces from the enemy and deliver the desired effect on the targeted objective. To properly analyze the AH-64 in deep operations, the threat force described here must possess a variety of combat systems common to potential enemies. It must also describe tactics, techniques, and procedures (TTP) for the threat that are, more or less, present worldwide.[58] Further, the assumption is made that most tactical deep operations using AH-64's will occur on a high to mid-intensity battlefield.

The threat model used in this monograph is a "capabilities based force" that is being developed as a generic enemy by the US Army Training and Doctrine Command.[59] The model is loosely based on the former Soviet Union's well-documented military doctrine. It incorporates doctrine and organizations from various foreign armies. This composite threat force is known as a capabilities-based opposing force (OPFOR). It is presumed to possess a wide range of capabilities available throughout the world rather than the forces of a particular nation. The OPFOR described below is an armor and mechanized ground force employed with some use of helicopters.

The ATKHB can engage the OPFOR decisively at great depths and destroy brigade or regimental size units. The battalion must fly over a large number of forces to reach the objective area and return to friendly territory. To best illustrate this, the OPFOR will be described at army level strength and capabilities. The monograph will concentrate on elements and doctrine that can influence or be affected by the ATKHB. This will require some discussion of operational doctrine but the analysis is primarily focused on tactics. The OPFOR tactics are combat actions at division level or lower.

The OPFOR attempts to achieve its operational goals by maneuvering an army division deep into friendly defenses. Their objective is normally the destruction of friendly combat units, command and control headquarters, or lines of communications. The OPFOR conducts two types of combat operations. The first is offensive. It is seen as the most decisive type of combat. The offense is employed to defeat the enemy's forces totally and capture important objectives. The OPFOR advances quickly with tank and motorized rifle units coordinated with aviation and airborne assault forces. They seek to gain the flank and rear of friendly forces by encirclement, or splitting his forces then defeating them in detail. The second type of combat operation is defensive. It is used to hold ground and protect valued resources in order to build up forces for launching an attack.

A typical OPFOR army consists of two to five divisions. The most common organization is four divisions. The tank army normally consists of three tank divisions and one mechanized division. The mechanized army is similar in design except that it has three mechanized divisions and one tank division. With three divisions in the first echelon, the OPFOR can provide a continuous front forward of a US Corps. The depth of this force is up to 15 kilometers in the offense and approximately 20 kilometers in the defense. The army's second echelon normally has one or more divisions. An army may form an OMG as large as a reinforced tank division. The second echelon and OMG are used in the offense while the defense uses only a second echelon. OPFOR second echelon units cannot cover the width of the battlefield. This pattern requires the ATKHB to penetrate a belt of enemy forces during deep operations. Once the ATKHB has penetrated first echelon forces they will encounter concentrations of OPFOR enroute to the objective area. These threat forces could be second echelon maneuver units, artillery units, antitank regiments, combat helicopter regiments, or air defense units.

The OPFOR army's objective for first echelon divisions is to disrupt friendly forces. After the first echelon attains the army's immediate objective, the army commander commits the second echelon divisions or an operational maneuver group (OMG). The second echelon divisions and OMG are high priority targets for US corps tactical deep operations. In the offense, the second echelon attacks to exploit first echelon successes by penetrating friendly tactical and immediate operational defenses. The OMG is used as a large operational raiding force. In the defense, the second echelon is usually a combined arms force that counterattacks or reinforces the first echelon on the main axis. Depending on terrain, second echelon forces and OMG's are located 50 to 150 kilometers behind the forward line of troops.

The OPFOR attacks with these follow-on forces by combining speed, maneuver, and firepower. They concentrate forces on a narrow front to establish a strike sector. This is done by combining second echelon forces and OMG's with artillery and aviation to mass effects and overwhelm friendly forces. The OPFOR stresses that fire support systems should combine air assets and artillery into a simultaneous attack throughout the enemy's defense. OPFOR front and army artillery and aviation are high payoff targets for the US corps in tactical deep operations. Army level artillery is located approximately 10 to 12 kilometers from the forward edge of the battle area. Front level artillery is located approximately 60 to 80 kilometers behind enemy lines.

The army commander commits the second echelon division or OMG from an assembly area. The committed division conducts a tactical march to their attack positions. Within the assembly area, the division disperses their units with their attached reinforcements. Each unit and subunit establishes reconnaissance and provides local protection from attacks. This is done by establishing hasty defensive positions using attached engineer units to prepare fighting positions. Air defense units are fully deployed to cover air avenues of approach. Army commanders establish assembly areas under the protection of both high altitude and low altitude air defense coverage. These assembly areas are well protected to ensure the second echelon divisions or OMGs are available when the army commander is ready to employ them.

The tactical march provides maximum rates of advance or maneuver to second echelon divisions and OMGs. The division deploys reconnaissance elements as far forward as 100 kilometers in front of their movement. Security for the force is provided to the front, flanks, and rear of the march formation. A reinforced battalion is formed as a forward detachment to seize key terrain for penetration or disrupt friendly covering forces. Flank and rear security for the main body are provided by maneuver regiments. The division normally moves along three routes and the lead regiments will provide an advance guard. The main body remains in the march formation as long as possible. Division artillery moves behind the first echelon regiment and the antitank reserve moves to cover the most exposed flank. The surface to air missile (SAM) regiment and other division air defense elements remain silent during movement. They depend on higher echelon air defense assets for early warning. The SAM regiment deploys a battery with each first-echelon maneuver regiment. The remainder of the SAM batteries are positioned on the flanks of the second echelon. The division is most vulnerable to attack by the US corps ATKHB's during the march.

OPFOR commanders and planners stress massed firepower as the key to success in combat. They try to accomplish their missions by fire and then by rapid exploitation with maneuver forces. The OPFOR utilizes artillery and air support to concentrate volumes of fire on friendly forces. The artillery is dispersed across the battlefield in battalion size formations to increase survival. They are protected with direct support air defense units. The OPFOR generally uses air defense ambushes against helicopters to protect their artillery positions. The artillery must also reposition after firing to ensure survival from counterbattery fire. The OPFOR commanders employ roving air defense elements to cover gaps in coverage during movement of the artillery. The OPFOR commander expends a large portion of his air defense assets to protect artillery. Artillery is one of the most high valued assets in his force.

The ATKHB is most effective against targets that are moving and not dug in for protection. The second echelon tank division or OMG in a tactical march presents the best target for the ATKHB. These formations present a large force that can be located and tracked with relative ease. When the corps triggers the ATKHB to attack, the ATKHB can move into position, develop the situation, and destroy large numbers of combat vehicles in a short period of time. If the OPFOR divisions are still in assembly areas, their prepared positions and well-coordinated air defenses present a much greater challenge to the ATKHB. The risk to the ATKHB increases exponentially against dug in forces versus forces in the tactical march.

The OPFOR possesses many weapon systems that are effective against the AH-64 and the ATKHB. The primary weapons used against helicopters are air defense artillery (ADA) systems and anti-aircraft artillery (AAA) guns. The OPFOR uses an area defense system. This allows the front and army to combine capabilities for a more comprehensive, overlapping, and mobile area air defense system. A weakness in this system is when the OPFOR is moving to attack. Holes in the air defense umbrella result from failures in communication and planning to keep pace with the advancing forces. ADA and AAA are the long range threats to the ATKHB. They are able to acquire and engage helicopters as far out as 24 kilometers. However, many of the radars and weapons are limited in their ability to acquire and engage below 50 feet at these ranges.[60] Some of the most effective systems are the shoulder fired missiles and short range AAA due to their density on the battlefield.

Tanks, armor personnel carriers, artillery, helicopters, fixed wing, and ground based machine guns also present a significant threat to the ATKHB. The OPFOR can mass weapons that are larger than 12.7 mm to attack the AH-64. These systems typically do not have detection or acquisition systems associated with them. They can acquire the ATKHB with observers using visual line of sight, laser detectors, or night vision systems. Once the ATKHB moves within approximately 3000 meters of the direct fire systems, the AH-64 becomes extremely vulnerable to heavy volumes of fire. The concentration of fire from the OPFOR is greater when the AH-64 gets closer to the threat. The ATKHB becomes vulnerable to OPFOR artillery systems, helicopters, and fixed wing aircraft once the battalion begins slowing to a hover.

The ATKHB can attack and destroy an OPFOR maneuver regiment in one mission. The OPFOR maneuver regiment contains approximately 210 combat vehicles. If the criteria for destruction of an enemy unit is 70% of these vehicles destroyed, the ATKHB would need to kill 147 vehicles.[61] With an operational readiness rate of 85%, the ATKHB can employ 20 of its 24 AH-64's on a given mission. The ATKHB commander would designate 12 AH-64's as attack helicopters and the rest as aeroscouts. The attack helicopters would carry 16 hellfire missiles and the aeroscouts would carry 8 missiles. This means that the ATKHB could carry 256 hellfire missiles. If the battalion performs in accordance with the data from Desert Storm, they can kill 166 individual targets. The battalion is able to retain some missiles for additional targets enroute to and from the objective area. The ATKHB uses the rockets and 30 mm cannon for self protection or destruction of enemy radar sites and C3 facilities.

The threat environment consists of many weapons systems that can engage and destroy the ATKHB. ADA presents the most dangerous threat, but all other combat systems can have a tremendous impact on the ATKHB during deep operations. The ATKHB provides the US corps commander an extremely lethal force that can decisively engage OPFOR exploitation and fire support forces. However, the ATKHB must successfully penetrate the OPFOR defenses and maneuver to a protected position for engagement in US corps tactical deep operations.

Conclusion

The best way for the US Army to plan for the use of the attack helicopter in the tactical deep operation is as an offensive maneuver force, a combat force that moves across the battlefield for positional advantage to deliver fires. The planning process for employment of attack helicopters, however, is much more involved than just the D3A methodology. The attack helicopter unit must have accurate intelligence, maneuver space, fire support, and continuous communications. The levels of command involved in the conduct of tactical deep operations must develop their plans for employment of attack helicopters in parallel with each other. The corps, ATKHR, and ATKHB each develops a plan in support of tactical deep maneuver by attack helicopters.

The D3A targeting methodology, as a planning process, places great emphasis on employment of the AH-64's firepower. However, it does not address the need for protection, mobility, and communications essential for realization of the desired effects. The D3A methodology provides trigger points to launch ATKHB's to engagement areas. It provides immediate reaction by fires once the designated *target* is located. To accomplish its mission, however, the ATKHB requires information on the enemy situation as a whole and not just the *target* and air defense weapons. The ATKHB requires maneuver graphics that provide for rapid movement to take advantage of its strength in mobility. Fire support coordination measures must be established to avoid duplication of fires and prevent fratricide. These types of control measures are sufficient for delivering effective and efficient fires, but do not in themselves facilitate movement of aerial firing units into a position from which to attack. The attack helicopter unit requires communication with the corps throughout the mission to coordinate fires and passage of lines. The unit commander also needs accurate and timely information from the corps on enemy dispositions.

The ATKHR is the best headquarters to focus employment of the AH-64. As a purely maneuver headquarters, it controls three ATKHB's and can defeat an OPFOR second echelon division in one mission. The ATKHR commander can task organize his forces to accomplish the mission directed by corps. The aviation brigade provides support as necessary to the ATKHR for successful mission accomplishment. The ATKHR should be under direct command and control of the corps commander for tactical deep operations.

Tactical deep maneuver is best executed through decentralized control of the ATKHR. However, elements of the planning process must be focused at the level of command that can see and organize the overall battlefield. The corps must coordinate the overall planning effort to optimize support, deconflict and synchronize efforts, and ensure assets are available. The corps plan must be simple, emphasize mission-type orders, and be flexible enough to respond to success or failure of the mission. The corps develops a plan that provides freedom of action to the ATKHR and provides sufficient support for success.

Army aviation can reach well into the rear of an enemy force and often causes an overlap between tactical and operational deep operations. The corps may require the ATKHR to maneuver beyond the range of organic intelligence and fire support. This requires extensive coordination and synchronization between adjacent units, theater supporting assets, and assets from supporting services. The corps staff must coordinate closely with the theater or joint task force (JTF) staff to ensure synchronization of all joint and combined assets. Without integrating the tactical deep operations plan into the plans for achievement of operational objectives, joint forces may not be available and conflicts with the theater or JTF commander's intent may result.

When theater or joint assets are required, the planning process is tied to the battle rhythm of the theater or JTF commander. This usually means that 72 hours are required to bring the appropriate amount of firepower to bear on the enemy. Joint doctrine generally designates the air tasking order execution time as H-Hour. At 72 hours prior to the associated air tasking order execution time, the corps decides to commit the ATKHR to a deep operation. The corps develops and distributes a warning order directing the ATKHR and all supporting units to prepare for the mission. The warning order identifies an area of operations and the enemy force to be attacked. At H-48 hours, corps issues an operations order directing the deep maneuver and associated support. This order delineates the deep concept of operation, requirements of supporting units, fire support coordination measures, air space management, and proper deconfliction and integration with theater or JTF operations. The corps continues to provide information to the ATKHR that is associated with the planned deep operation throughout execution of the deep maneuver.

Through battlefield area evaluation, the corps G3 and G2 develop a battlefield framework for the tactical deep maneuver. The battlefield framework consists of a deep area of operations (DAO), an area of interest that may affect the DAO, and air corridors. Designation of these elements focuses the efforts of the ATKHR and supporting forces. It also assists the G2 and G3 in focusing information collection efforts so the corps and ATKHR commanders can *read the battlefield* and make proactive decisions. Additionally, the corps designates this battlefield framework to coordinate passage of lines and ensure synchronization of the corps effort. (Figure 1 depicts the proposed battlefield framework.)

The G2 provides an intelligence estimate to the ATKHR encompassing the entire battlefield framework. This estimate contains information on weather, terrain, enemy disposition, and the targeted force. Included with the estimate should be an event template and decision support template from the corps intelligence preparation of the battlefield (IPB). These templates must include enemy air defenses capable of directly or indirectly alerting and engaging the ATKHR. They must also include any ground and aviation forces that could impact on the ATKHR throughout the deep battle.

The G3 provides a deep concept of operations, fire support plan, and communications plan. The concept of operations concentrates corps maneuver and fires for maximum effects on the enemy force. It also ensures that the deep, close, and rear battles are mutually supporting. The fire support plan will designate supporting field artillery units and air assets. It will include lethal and non-lethal fires to enhance effects on the targeted enemy force and protect the ATKHR. Fire support coordination measures and airspace control measures are provided by the G3 to focus fires and protect the ATKHR from friendly fires. These measures, along with the DAO, allow the ATKHR

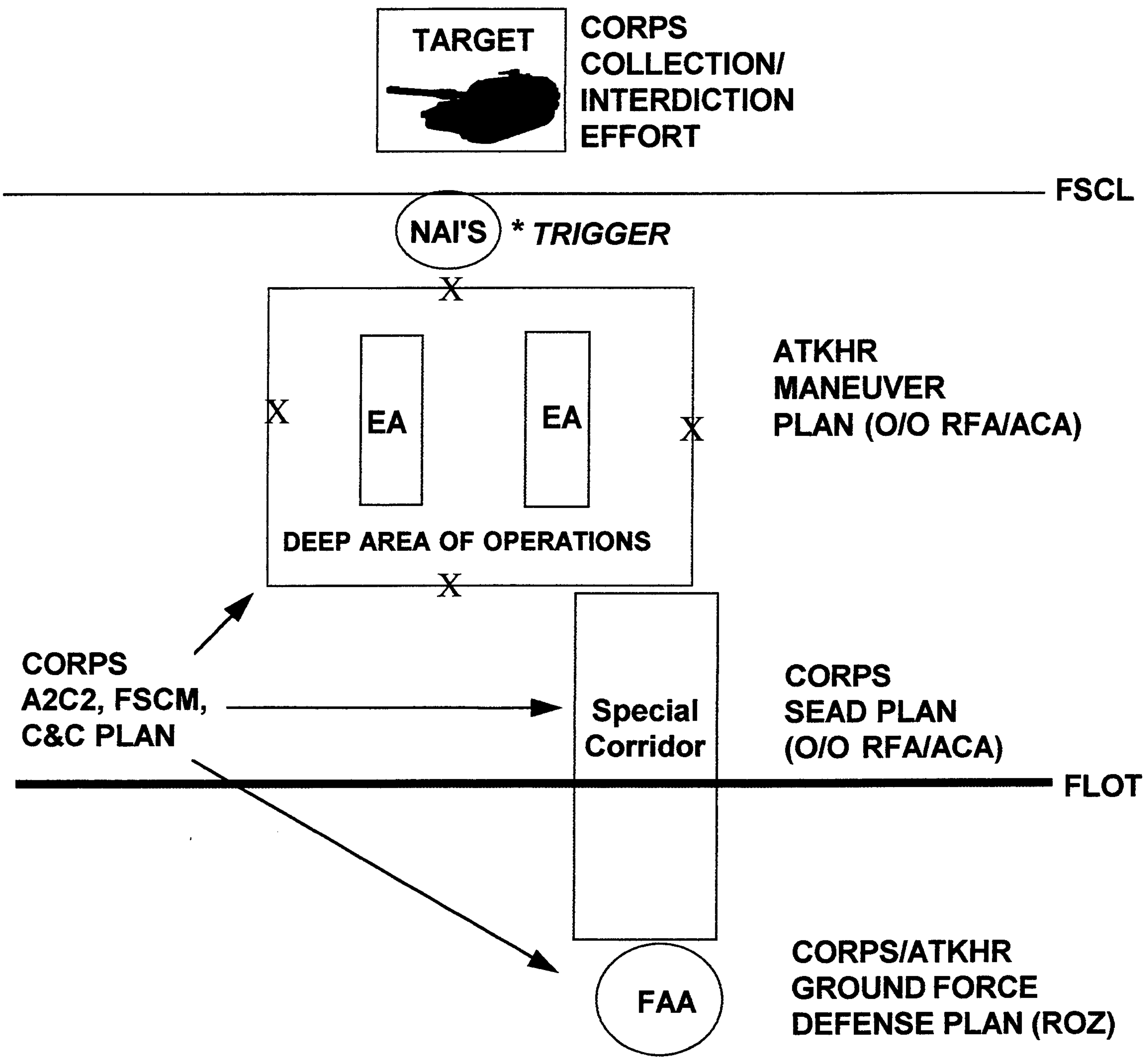
TARGET
CORPS
COLLECTION/
INTERDICTION
EFFORT
FSCL
NAI'S
* TRIGGER
ATKHR
MANEUVER
PLAN (O/O RFA/ACA)
EA
EA
DEEP AREA OF OPERATIONS
CORPS
A2C2, FSCM,
C&C PLAN
Special
Corridor
CORPS
SEAD PLAN
(O/O RFA/ACA)
FLOT
FAA
CORPS/ATKHR
GROUND FORCE
DEFENSE PLAN (ROZ)

Figure 1.

commander to coordinate all fires within his area of operations. The communications plan must provide the ATKHR frequencies of all supporting units, a deep command and control frequency, SATCOM frequencies, and HF radio frequencies. It must also provide a central node for line of sight communications from the AH-64 or UH-60 command and control helicopter. Line of sight communications over great distances for helicopters at terrain altitude require this central node to be at a high altitude. The corps must commit organic aviation assets or coordinate for Air Force ABCCC aircraft.

The ATKHR's main focus is on its close fight within the DAO. The ATKHR is conducting a close fight and must plan as they would in close offensive operations. The ATKHR's maneuver plan for this close fight requires the full effort of the regimental staff. It receives the warning order from the corps and begins developing the regiment's plan concurrently with the corps. The ATKHR produces a warning order and issues it to the ATKHB's. Once the ATKHR receives the corps operations order, it uses the deliberate decision making process to develop and issue a regimental operations order. The ATKHR uses only one-third of the time available prior to execution to produce this order. This provides the order to the ATKHB's at approximately H-36 hours.

This operation is planned as an offensive operation using offensive planning factors, forms of tactical offense, and forms of maneuver. The concept of operations expresses the ATKHR commander's planned scheme of maneuver. This scheme of maneuver describes the movement, positioning, and tasks to the ATKHB's from the FAA through the actions on the objective and egress back to the FAA for reconstitution. The plan defines the offensive framework of; reconnaissance and security, main and supporting attacks, reserve, and rear operations. The ATKHR must first conduct reconnaissance operations to develop the situation and test the enemy's dispositions, strength, and reactions. Once the ATKHR commander understands the situation, he commits his main and supporting attacks to accomplish his mission. The ATKHR commander retains a small reserve to reinforce or exploit success. Front, flank, and rear security of the ATKHR are normally conducted by each ATKHB as part of their assigned mission.

The ATKHR provides products and information to the ATKHB's that is similar to the corps products. However, the ATKHR refines the estimates and information to greater detail. The ATKHR S2 focuses the intelligence preparation of the battlefield effort to provide the commander detailed terrain, weather, and enemy information. The S2 develops appropriate targeted and named areas of interest that support the regimental attack and the corps' deep operations.

The ATKHR S3 develops the concept of operation to synchronize the maneuver plan with fires provided by corps. The S3 establishes maneuver graphics, distributes fire support, designates fire support coordination measures and airspace control measures, and develops a communications plan. He must coordinate additional resources with the corps as necessary to accomplish the mission. The S3 works concurrently with the corps G3 throughout the entire planning process to ensure efforts are coordinated and required support is available.

The ATKHB receives the plan and concentrates on small unit tactics, fire distribution, and rehearsals. They receive an area of operations from the ATKHR and execute their attack in accordance with the planned concept of operation. The ATKHB is responsible for coordination with the other ATKHB's and the ATKHR for necessary support. Self protection and mission accomplishment are the ATKHB's primary concern. They develop a plan that emphasizes these two factors and provide the plan to the ATKHC's.

The ATKHB can be the reconnaissance, security, attack, or reserve force for the ATKHR. The battalion maneuvers from the FAA through a penetration box to the DAO. While maneuvering through the air corridor, from the penetration box to the DAO, it bypasses enemy forces or engages targets of opportunity. This criteria is established by the higher headquarters order. If supporting artillery or air does not suppress threats to the helicopters, the battalion must provide its own suppression. The ATKHB maneuvers within the area of operations established by the ATKHR to gain position on the enemy. The battalion engages to destroy the enemy once the battalion commander can mass the effects of his combat power in the engagement area. The ATKHB must maneuver from the DAO, through the established air corridor, to the passage point. This is accomplished similar to the maneuver to the DAO. The ATKHB can destroy one regiment during this mission. It also provides the corps accurate and timely information on the environment that the battalion is operating. The employment of this aviation maneuver unit in tactical deep operations is obviously a high-risk endeavor. However, the results of the employment can be decisive to the corps' battle.

According to Tukhachevskiy and Franks, simultaneity is key to conducting combat operations on an expanded battlefield. The AH-64 can contribute firepower and mobility to decisively engage the enemy's rear and wrest the initiative from the enemy commander. The most complex and risky part for the ATKHR in tactical deep operations is maneuver through enemy territory to and from the objective area. The corps must develop a plan that incorporates the ATKHR in simultaneous operations across the corps' expanded battlefield and protects it from disastrous results. This plan must emphasize the maneuver as much as the fires portion of tactical deep operations.

ENDNOTES

[1]See discussion, p. 30-32.

[2]Fire support manuals describe the targeting methodology in terms of fires. The D3A functions focus predominantly on target selection and effects of the weapon system on the target. Headquarters, Department of the Army, *Field Manual 6-20, Fire Support in the Airland Battle* (17 May 1988). Headquarters, Department of the Army, *Field Manual 6-20-10, Tactics, Techniques,and Procedures for The Targeting Process* (8 May 1996), 2-1 thru 2-16. Headquarters, Department of the Army, *Field Manual 6-20-30, Fire Support for Corps and Division Operations* (18 October 1989), 4-16 thru 4-19.

[3]See U.S. Army Training and Doctrine Command, *TRADOC Pamphlet 11-9 , Blueprint of the Battlefield* (27 April 1990), 7-1 and 7-2.

[4]The author is an attack helicopter pilot with experience in the AH-1 Cobra and the AH-64 Apache. The majority of his work has been with corps and theater level deep operations in the AH-64. He has served in Ft Hood, TX, Federal Republic of Germany, Desert Shield/Storm, and Korea while planning and executing tactical deep operations. He has also been an Observer/Controller with the Battle Command Training Program and has observed tactical deep operations in four Warfighter Exercises.

[5]See Combined Arms Combat Development Activity, Program Integration Office -- Tactical Missile Defense/Deep Operations/ Reconnaissance, Intelligence, and Target Acquisition, US Army Training and Doctrine Command, *Corps Deep Operations (ATACMS, Aviation and Intelligence Support) Tactics, Techniques and Procedures Handbook* (1990). (Hereinafter, *Corps Deep Operations Handbook*).

[6]The frame of reference for "the next battlefield" in this monograph refers to the next five years to limit the predictive nature of the paper. The analysis for this paper will concentrate on what is known to develop a theory for employment. The author attempts to remove some of the uncertainty by dealing with systems and organizations that are currently fielded or currently purchased for fielding within the US Army. See Headquarters Department of the Army, *Table of Organization and Equipment (TOE) 01400A200, Corps Aviation Brigade* (20 August 1997).

[7]See Headquarters, Department of the Army, *Field Manual 100-5, Operations* (14 June 1993), 6-14.

[8]ibid, 6-14.

[9]See Christopher D. Bellamy, *The Evolution of Modern Land Warfare, Theory and Practice*, (London: Routledge, 1990), 67.

[10]See Ned Bradford, ed., *Battles and Leaders of the Civil War*, 2nd ed. (New York: Hawthorne Books, 1887/1888; reprint, New York: Fairfax Press, 1979), 152.

[11]See John L. Collins, *A Prisoner's March from Gettysburg to Staunton,* in *Battles and Leaders of the Civil War*, ed. Ned Bradford, 2nd ed. (New York: Hawthorne Books, 1887/1888; reprint, New York: Fairfax Press, 1979), 401.

[12]ibid, 406.

[13]See Bellamy, *The Evolution of Modern Land Warfare,* 127-130.

[14]ibid, 128.

[15]ibid, 128.

[16]ibid, 130.

[17]ibid, 64-65.

[18]See Richard E. Simpkin, *Deep Battle* (London: Brassey's Defence Publishers, 1987), 37.

[19]ibid, 36.

[20]ibid, 36.

[21]ibid, 182. "Soviet Field Regulation 1936 (PU-36)" gives a good description of Tukhachevskiy's thoughts on

[22]ibid, 39. This definition is taken from a quotation by Tukhachevskiy on "modern means of neutralisation".

[23]Richard E. Simpkin, *Race to the Swift* with a forward by General Donn A. Starry, US Army (Retired) (London: Brassey's Defence Publishers, 1985, reprint, Great Britain: A. Wheaton & Co. Ltd., Txeter, 1986). See Simpkin'*s Race to the Swift* and Bellamy's *Evolution of Modern Land Warfare* for a further discussion on the OMG. After WWII, the soviets began to recover the ideas produced by the deep operations theorists prior to the purge by Stalin in the late 1930's. This resulted in a theory of operational deep maneuver.

[24]See Simpkin, *Race to the Swift*, 43.

[25]The "Big Five" was also a General Depuy initiative. It included the M1 Abrams tank, the M2 and M3 Bradley fighting vehicles, the Blackhawk and Apache helicopters, and the Patriot air defense missile. At one point it was known as the "Big Eight". These systems are described in John L. Romjue's *Prepare the Army for War: A Historical Overview of the Army Training and Doctrine Command 1973-1993* (Fort Monroe, VA.: Office of the Command Historian, U.S. Army Training and Doctrine Command, 1993), 44.

[26]LTC L. D. Holder wrote an article on deep maneuver in 1982. This describes some of the thoughts by the doctrine writers when the deep operations theory was being developed. LTC L. D. Holder, "Maneuver in the Deep Battle, *Military Review*, LXII, no. 5 (May 1982): 55-61.

[27]LTG Crosbie E. Saint was the III Corps Commander during the mid-1980's and began to promote the idea of deep maneuver with attack helicopters to influence the US Army corps commanders' deep fight. This may have also been a reaction to the US Air Forces' perceived inability to respond to and sustain battlefield air interdiction for the army. General Crosbie E. Saint, "Attack Helicopter Operations in the Airland Battle: Deep Operations," *Military Review* LXVIII, no. 7 (July 1988): 2-9.

[28]See Tom Clancy with General Fred Franks Jr. (Ret.), *Into the Storm, A Study in Command* (New York: G. P. Putnam's Sons, 1997), 269, 320, 541, 382-384.

[29]See Romjue, *Prepare the Army for War*, 145.

[30]See *Field Manual 100-5, Operations* (1993), 2-7 thru 2-8, 6-13, 9-4.

[31]TRADOC Systems Manager for Longbow, U.S. Army Aviation Warfighting Center, *Longbow Update*, briefing (6 August 1997). This briefing was given to aviation officers attending CGSC class 97/98. A slide was shown detailing the current fielding plan.

[32]Information concerning the AH-64 in this monograph comes from three primary sources unless otherwise noted. Headquarters, Department of the Army, *Field Manual 1-112, Attack Helicopter Operations* (2 April 1997). Headquarters, Department of the Army, *Field Manual 1-140, Helicopter Gunnery* (29 March 1996). Authors experience as described above.

[33]This approach to describing the AH-64 as a tactical combat system comes from Bellamy's *The Evolution of Modern Warfare*, 25.

[34]Brief by the President of the Board. LTG Hamilton H. Howze, *Final Report, Tactical Mobility Requirements Board*, (Fort Bragg, N.C., 20 August 1962), 2.

[35]This condition is present in all systems that use FLIR. *Field Manual 1-112, Attack Helicopter Operations* (1993), A-5.

[36]See Kenneth C. Jensen, *Apache Checkride* (Enterprise, Alabama: Kujo's Electric Press, 1995), 189.

[37]ibid, 213.

[38]Erin Oleson, "Promises Kept--First AH-64D Apache Longbow Rolls Out, Delivers On Time," *Apache News* (April 1997), 2.

[39]ibid, 3.

[40]See Director of Training and Doctrine, U.S. Army Aviation Warfighting Center, *AH64D Longbow Apache Tactics, Techniques, and Procedural Methods of Employment* (1 June 1993), 5.

[41]ibid, 7.

[42]Helicopter Gunnery Department, Directorate of Training and Doctrine, U.S. Army Aviation Warfighting Center, *Live Fire Data*, briefing (10 January 1994). This data was developed to assess training in USAREUR. It is representative of the training proficiency of the average AH-64A crew in the U.S. Army.

[43]US Army Aviation Warfighting Center, *Army Aviation Desert Shield/Storm After Action Report* (28 June 1991), F-4. This percentage of hits for the PTWS demonstrates the difference between proficiency on a sterile range versus actual combat conditions. Part of the differences are a result of environmental conditions.

[44]See *FM 1-140, Helicopter Gunnery* (1996), 7-3.

[45]See John S. Crowley, "Human Factors of Night Vision Devices: Anecdotes from the Field Concerning Visual Illusions and Other Effects" (Fort Rucker, Alabama: United States Army Aeromedical Research Laboratory, May 1991), 3.

[46]Two letters from the Secretary of Defense viewed the helicopter as operating in the environment of the ground. LTG Hamilton H. Howze, *Final Report, Tactical Mobility Requirements Board* (1962), Inclosure 1.

[47]See US Army Aviation Warfighting Center, *Aviation Warfighting Treatise* (August 1993), 7.

[48]*Field Manual 1-112, Attack Helicopter Operations* (1997), *Corps Deep OperationsHandbook* (1990), and the author's experience are used for the discussion of ATKHB employment, command and control structure, and planning methodology, unless otherwise stated. Most active corps' have their own standard operating procedures that closely match the 1990 Handbook.

[49]See *Army Aviation Desert Shield/Storm After Action Report* (1991), F-4.

[50]*Field Manual 1-112, Attack Helicopter Operations* (1997), 1-6.

[51] *Corps Deep Operations Handbook* (1990), 1-5.

[52]ibid, 1-6.

[53]*Field Manual 6-20-10, Tactics, Techniques, and Procedures for The Targeting Process* (1996), 2-1.

[54]ibid, 2-1.

[55]See Headquarters, Department of the Army, *Field Manual 100-15,Corps Operations* (1 June 1996), 4-11.

[56]Experience from Desert Shield/Storm indicate that the aviation brigade is overloaded with information for the size of staff available. *Army Aviation Desert Shield/Storm After Action Report* (1991), C-23.

[57]The author's research of doctrinal manuals does not reveal exact dimensions of a corps area of operations. These manuals state dimensions in ambiguous terms. The size and shape of a corps commanders area of operations is dictated by his ability to employ his organic, assigned, and supporting systems to the full extent of their capabilities. *FM 100-5, Operations* (1993), p. 6-12. *FM 100-15, Corps Operations* (1996), 2-4. The author's experience, noted above, provides a general idea of the size of a corps area of operations. The dimensions are approximately 100 kilometers in width, 300 kilometers in length, and 500 feet in height. This area is framed by the corps rear boundary, the forward edge of deep operations, lateral boundaries, and a coordinating altitude.

[58]The military leaders in the United States have stated that the enemy we will face in the future comes from an unknown nation. However, this threat is sure to have modern weapons and methods for employing those weapons. In a recent article, General Dennis J. Reimer writes of this uncertainty and lists nations that can present a highly capable threat to the US military. General Dennis J. Reimer, US Army, "Challenge and Change: A Legacy for the Future," *Military Review* LXXVII, no. 4 (July-August 1997), 109.

[59]The basic data on the threat in this monograph comes from two sources unless otherwise noted. Headquarters, Department of the Army, *TRADOC Pamphlet 350-16, Heavy Opposing Force (OPFOR) Tactical Handbook (Draft)* (15 September 1995). Headquarters, Department of the Army, *FM 100-60, OPFOR Armor-and Mechanized-Based Opposing Force Organization Guide*, (16 July 1997).

[60]Jane's publications on military equipment provide a detailed description of the military hardware listed for the OPFOR. Air defense systems are described in Jane's *Land-Based Air Defence, edited by Tony Cullen and Christopher F. Foss*, eighth edition, (Coulsdon, Surry, UK: International Thomson Publishing Company, 1995-96).

[61]There is no doctrinal requirement for 70% destruction criteria. This figure is determined by the corps commander. FM 6-20-10 defines destruction fires as, "physically render[ing] the target permanently

combat-ineffective or so damaged that it cannot function unless it is restored, resconstituted, or rebuilt." *FM 6-20-10, The Targeting Process* (1996), 2-8. For analysis purposes, the figure of 70% was drawn from *Corps Deep Operations Handbook* (1990),,4-40.

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