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THE COMBAT USE OF APACHE HELICOPTERS IN THE KUWAITI THEATER OF OPERATIONS--EFFECTIVE OR NOT?

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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B.A., Jacksonville State Univ, Jacksonville, Al., 1980

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During DESERT STORM, Army Aviation established that it has matured as a combat arm. When employed in close combat, aviation is deadly and decisive. Aviation forces can deliver decided combat power to formidable operational depths, poising itself as the principal maneuver arm of AirLand Battle operations in the nineties. During DESERT STORM, Army Aviation operations demonstrated how rotary-wing aircraft can accelerate the tempo of conventional combat. The executive summary in the U.S. Army Aviation Center's DESERT SHIELD/STORM After Action report stated, "We won the war, but in many areas, we did not win in the most efficient and effective way." The study discusses the state of the equipment immediately before and during DESERT SHIELD and DESERT STORM. It relates the technical and tactical proficiency of Apache crews to their combat effectiveness. The study relates high-intensity mission schemes and fleeting skills to training issues.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE COMBAT USE OF APACHE HELICOPTERS IN THE KUWAITI THEATER OF OPERATIONS--EFFECTIVE OR NOT? by MAJ Randy C. Nelson, USA, 104 pages.

During DESERT STORM, Army Aviation established that it has matured as a combat arm. When employed in close combat, aviation is deadly and decisive. Aviation forces can deliver decided combat power to formidable operational depths, poising itself as the principal maneuver arm of AirLand Battle operations in the nineties. During DESERT STORM, Army Aviation operations demonstrated how rotary-wing aircraft can accelerate the tempo of conventional combat.

The executive summary in the U.S. Army Aviation Center's DESERT SHIELD/DESERT STORM After Action report stated, "We won the war, but in many areas, we did not win in the most efficient and effective way."

The study discusses the state of the equipment immediately before and during DESERT SHIELD and DESERT STORM. It relates the technical and tactical proficiency of Apache crews to their combat effectiveness. The study relates high-intensity mission schemes and fleeting skills to training issues.

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CHAPTER 1

OVERVIEW OF DESERT SHIELD AND DESERT STORM

This thesis will answer the question, "Was the combat use of Apache helicopters in the Kuwaiti Theater of Operations effective or not?" My goal was to analyze the training, doctrinal employment, equipment, and performance of Apache units during DESERT STORM. I applied the question, "Are Apache units good enough for the next war?" to highlight improvements which Apache units might need to successfully attain their warfighting mission.

The general principles of warfighting revolve around three essential factors: man, machine, and environment. The nature of warfare dictates studying these factors as interacting elements. In this case, the machine is the AH-64 Apache Helicopter and its subsystems. The human (man) factor involved employment, doctrine, and training; the environment was the harsh Arabian Desert.

DESERT SHIELD began with a rapid deployment of men and equipment to the heat and sand of the Saudi Arabian Desert. Their mission? to fend off the Iraqi threat. The XVII Airborne Corps, as the major land force, defended Saudi using tactics that employed a mobile defense concept.

Throughout the force-development phases of DESERT SHIELD, U.S. Army aviation units provided the mobility of the 101st and the 82nd Airborne divisions. Apache units represented the land force's primary tank-killing force and mobile security force.

In the initial defense of Saudi Arabia, the 12th Aviation Brigade received a covering-force mission along the Kuwait border. Comprising an area of operations with the dimensions normally associated with a much larger armored cavalry regiment. The 12th Aviation Brigade accomplished this covering-force mission with only two AH-64 battalions and organic lift support.

In November 1990, XVIII Airborne Corps, VII Corps, and various echelons above corps (EAC) support elements received orders authorizing the planning of offensive operations. They then began drawing up the tactical details for DESERT STORM. Under cover of the ruse of positioning a credible Marine Expeditionary Force amphibious assault force off the coast of Kuwait, the secret shift of XVIII Airborne Corps and VII Corps forces far to the west of Kuwait began and DESERT SHIELD became DESERT STORM.

During the initial execution of DESERT STORM, attack helicopter units were out front. Apache units destroyed key Iraqi radar positions, while Army aviation special operations forces provided electronic countermeasures support. Together they destroyed a key communications control bunker complex.[1]

These initial Apache missions were key to the joint suppression of enemy air defenses (J-SEAD) campaign that inaugurated the coalition's air campaign. The Apache units' successes compounded the overall success of the air campaign and directly contributed to the low casualty rates. Many Apache battalions conducted preoffensive armed reconnaissance and counterreconnaissance. Apaches crossed the forward line of own troops (FLOT) on many occasions before the coalition force's ground offensive began.

Coalition forces began a ground offensive at 0400, Saudi time, on 24 February 1991. Attack helicopters, air reconnaissance, air cavalry, and aerial target acquisition elements crossed the FLOT well ahead of ground maneuver units. Apaches routinely operated 20 kilometers ahead of ground elements and shaped the battlefield through armed reconnaissance and attack operations. Both XVIII Airborne and VII Corps planned and executed deep attacks and deep armed-reconnaissance Apache missions. These deep-attack missions shaped the battlefield and set the terms for close operations. Successful deep operations cleared the way for mass pursuit operations by coalition land forces which routed the Iraqi Army.

The coalition's ground offensive quickly turned to exploitation and pursuit operations. The tempo of the battle increased as the battlefield became nonlinear. Army aviation resources provided the mobility, flexibility, and agility required to continue the pursuit. Attack helicopter units placed continued pressure on the enemy while steadily increasing the tempo of battle to a point of inundation.

Apache helicopters were instrumental in providing force security during "cessation of offensive operations" ordered by the president. During this period, retreating Iraqi units again engaged U.S. armored forces. U.S. tanks and Apache helicopters worked together to defeat the withdrawing Iraqi forces. In these last major engagements of the war, estimated Iraqi losses included 140 armored vehicles.

XVIII Airborne and VII Corps' operational areas between the Saudi Arabian border and Iraq's Euphrates River valley were established as coalition-force security zones and the XVIII Airborne Corps began its ordered withdrawal from Iraq to positions in Saudi Arabia.

Army aviation units once again received and performed area covering-force missions as aviation pure elements. Aviation elements of VII corps and a French aviation squadron were then adequate to safeguard a coalition-force security zone once occupied by two U.S. Army divisions.

NOTE: See Appendix A for a complete chronology of DESERT SHIELD and DESERT STORM actions.

ENDNOTES

1. "Tracking the Storm," Military Review, Volume LXXI (September 1991): 75.

CHAPTER 2

APACHE EQUIPMENT AND MISSION SYSTEMS

Apache attack helicopter battalions are equipped with the AH-64 Apache attack helicopter. The AH-64 Apache is a two-seated, twin-engine, rotary-wing aircraft (Figure 1). The Apache delivers antiarmor and area suppression fire in day, night, and adverse weather conditions. The Apache represents an optimization of helicopter technology for the modern tank-heavy battlefield environment. Army Aviations' Apache helicopter contributes to the U.S. Army's ability to fight outnumbered and win!

The Apache provides a highly effective means of delivering massed firepower. The weapons systems of the Apache include Hellfire antitank missiles, a 30-millimeter (mm) area suppression cannon, and 70-mm rockets. The aircraft's fire control computer integrates the weapons systems with ballistic and windage calculations. These calculations provide the Apache crews with missile launch constraints and aiming data for 70-mm rockets and the 30-mm cannon.

Figure 1. AH-64 Apache
Photo by Hughes Helicopters, file number 03831540

To enhance its survivability, the Apache incorporates redundant flight controls, armor plating of critical aircraft components, and electronic countermeasures equipment. These survivability designs establish the Apache as an "exceedingly hard" helicopter. The Apache's electronic countermeasures include air defense radar warning receivers, missile detectors, chaff dispensers, radar jammers, and infrared missile jammers. The Apache's sophisticated design further enhances these survivability systems. The Apache's structural and component designs provide reduced aural and visual signatures and low detectability in radar and infrared target acquirement spectrums.

The heart of the Apache, as a weapon systems platform, is its night vision systems and its target acquisition and designation system. These systems provide the Apache its ability to fly and fight at night and in adverse weather.

In DESERT STORM the overall success of the Apache in integrating its lethality with ground maneuver forces was outstanding. "Very few major system failures were reported, and the U.S. soldiers' ingenuity provided work arounds to get the mission done."[1]

Aviators did report on specific equipment and interoperability problems with other army and coalition aircraft and ground forces. Specific equipment shortfall areas included navigational equipment, radios, aircraft-survivability equipment, IFF transponders, and 30-mm weapon systems performance.

NIGHT VISION AND SIGHTING SYSTEMS

The Target Acquisition and Designation System/Pilot Night Vision Sensor (TADS/PNVS) provides the Apache its day, night, and limited adverse-weather targeting information and night-navigation capabilities. A rotating turret mounted on the nose of the aircraft houses these systems. The maximum slew rate of the TADS/PNVS turret is 60 degrees per second.[2]

The target acquisition and designation (TADS) provides the Apache's copilot/gunner with search, detection, and recognition capability (Figure 2). TADS incorporates a 126X maximum magnification power "day television" (daytime only). It also provides a 36X-power forward-looking infrared (FLIR) sighting system, and an 18X-power telescopic direct-view optical (DVO) system. These systems operate singly or in combination. Factors affecting the use of the TADS system include the intensity of the tactical situation, visibility restrictions, and weather conditions.

The TADS day television operates in the near-infrared region of the "day-light" spectrum. This near-infrared region provides the best visible light spectrum performance in smoke, haze, and other conditions of limited visibility.

The TADS FLIR system provides thermal imaging to the pilot or copilot/gunner, allowing the crew to peer through smoke, fog, and darkness.

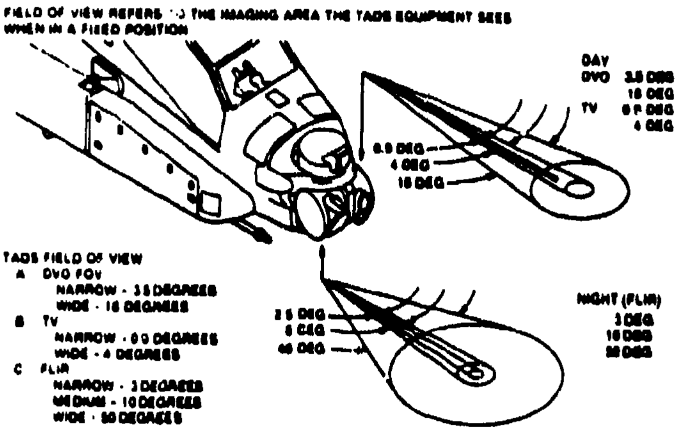

Figure 2. Target acquisition and designation system (TADS).

The Pilot Night-Vision System (PNVS) consists of a FLIR sensor system, packaged in a rotating turret mounted on the nose of the aircraft. The PNVS FLIR provides the pilot an unmagnified thermal image with a 30-degrees-vertical times a 40-degree-horizontal field of view. The system focuses on objects at distances from 10 feet to infinity.[3]

The Apache crew receives the FLIR images along with superimposed flight symbology and navigation and targeting information on helmet-mounted or dash-mounted video displays. The PNVS is housed in a horizontally rotating turret which is mounted on the nose of the aircraft above the TADS/PNVS turret (Figure 3). The slew rate of the PNVS turret is 120 degrees per second.

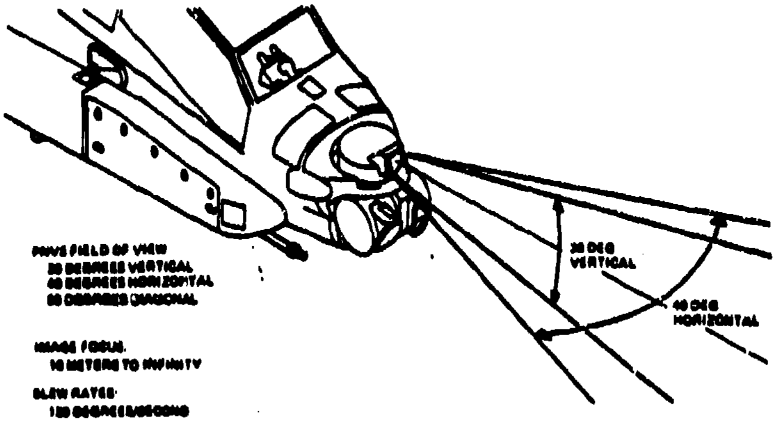

Figure 3. Pilot night vision system (PNVS)

HELLFIRE MISSILE SYSTEM

The Apache's point target weapons system, commonly called "Hellfire," is the primary armament system on the helicopter. Hellfire provides the Apache a capability to destroy tanks and hard-material targets at standoff ranges. The Hellfire system provides the capability to fire laser guided missiles on or off the ground at speeds from a hover to maximum-level flight speeds.

Hellfire modular launchers mount on any of the aircraft's four wing stations. Each Hellfire launcher has four launch rails and can accommodate up to four AGM-114 Hellfire missiles. The number of missiles carried on a mission depends on assignment profiles. Normally, Apaches deploy with missile loads of 8 to 16 Hellfires.

The guidance system for the Hellfire missile centers around a laser energy seeker. Targets are designated by being illumination with a coded frequency laser beam. The missiles laser energy seeker senses the reflected laser energy and homes the missile to the target.[4]

The Hellfire missile's warhead consist of a powerful 17-pound, 7-inch-diameter, conical-shaped, explosive charge. The warhead is designed to burn through the armor found on any known main battle tank. The published range of the Hellfire is more than 3.7 miles. Missiles used in DESERT SHIELD and DESERT STORM included the AGM-114A, high-trajectory missiles, and the AGM-114C, lower-trajectory minimum-smoke model.

The Hellfire system provides an antiarmor capability of--

- o Multiple-target engagements.
- o Day, night, and adverse-weather operations.
- o Extended ranges.
- o Short (supersonic) flight times.
- o High, single-shot, hit probabilities.
- o Indirect fires.

Hellfire missiles offer a variety of employment modes, from direct-fire, autonomous engagements to indirect fire. In coordinated team attacks, the Apache can launch

Hellfire missiles at unseen targets from maximum ranges using remotely located laser designators (Figure 4). In anti-air mission profiles, the high-G maneuvering ability and supersonic speed makes the Hellfire missile effective against slow-moving aircraft.

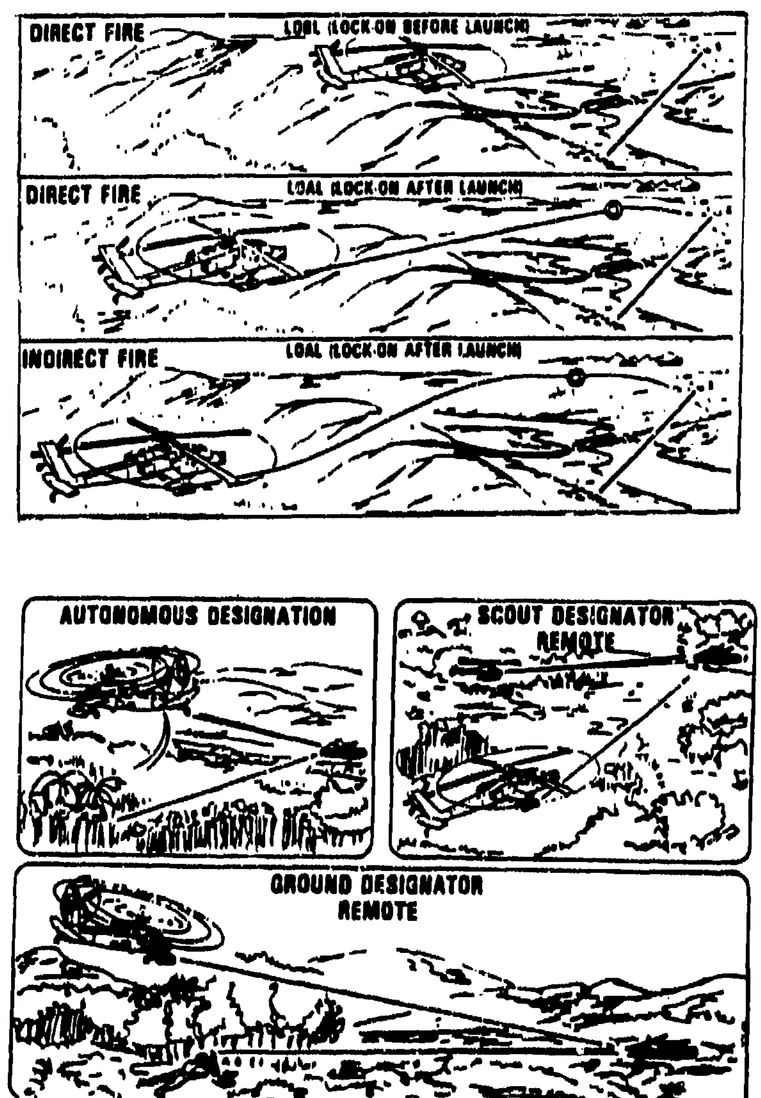

Figure 4. Hellfire launch modes

30-MILLIMETER CANNON

The Apache employs a belly-mounted, McDonnell-Douglas, M230, automatic, 30-mm cannon (Figure 5). The 30-mm cannon is an area weapon primarily used to provide suppressive fire. The weapons cyclic rate of fire is 600 to 650 rounds per minute. A 1,200-round magazine provides the Apache its onboard, 30-mm ammunition storage. The 30-mm cannon can destroy soft targets and lightly armored vehicles out to 4,000 meters. The cannon mounts in a hydraulically driven turret capable of slewing 110 degrees right or left of the helicopter's center line. The weapon has a maximum elevation of 11 degrees up and 60 degrees down. Crew members accomplish 30-mm cannon targeting by helmet mounted-sight or the gunner's target-acquisition systems. When selected, the 30-mm cannon is slaved to and tracks the crew member's selected line-of-sight. The Apache's fire control computer provides corrected ballistic solutions for the selected target, and aims the 30-mm cannon. The look-and-shoot capability of the 30-mm cannon system provides responsive and effective suppressive fire out to 3,000 meters.[5]

Apache units in operation DESERT STORM employed high-explosive and high-explosive/dual-purpose 30-mm ammunition. Tracer rounds are not available for the 30-mm cannon.

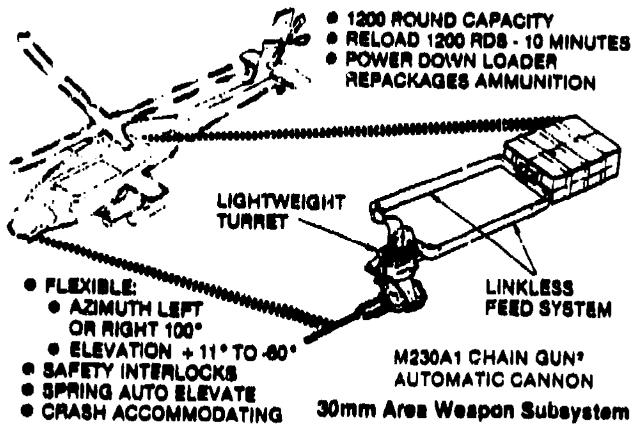

Figure 5. 30-mm cannon

70-MILLIMETER ROCKETS

The 70-mm aerial rocket control system serves as a light, antipersonnel, assault weapon (Figure 6). The rockets are launched from launcher pods that hold up to 19 rockets each. The 19-tube launcher pods mount on any of the Apache's four wing stations. Routine configurations mount launcher pods in pairs. Pair configurations allow Apaches to deploy with a maximum of 38 or 76 rockets. The 70-mm rockets fire effectively throughout the aircraft's flight regimes, including fires when hovering and during high-speed flight.[6]

The Apache's fire control computer provides rocket aiming and aircraft steering commands. Either pilot can receive this information as it is displayed to either station. The information is shown as weapons symbology and provides corrected solutions for internal and external ballistic equations. In flight, the Apache's pilot selects the desired type of 70-mm warhead, fuze setting, desired quantity of rockets to be fired, and target range for specific engagements. Pre-mission planning determines the type and quantity of rockets carried aboard the Apache.

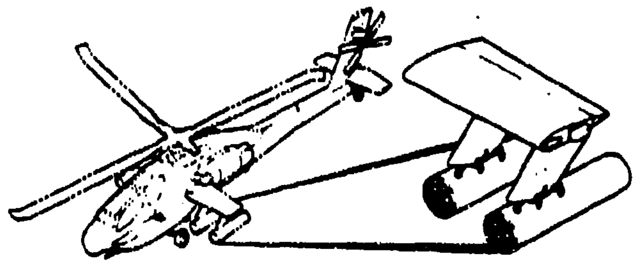

Figure 6. 70-mm rocket system

Older generation 70-mm rockets have 6.5-inch folding stabilization fins and an MK40 rocket motor. The MK40 can propel rockets to a maximum range of 6,000 meters. The modernized version of the MK40 rocket motor is the MK66. The MK66 rocket motor incorporates wraparound stabilization fins. The fin-and-nozzle configuration of this modernized rocket motor allows the rocket to "spin-up" in the launcher pod prior to launch. The spin-up of the rocket provides increased trajectory stability. The MK66 rocket motor maximizes the accuracy and warhead effectiveness of 70-mm rockets. The maximum range of a 70-mm, MK66 rocket is 8,800 meters.

A broad range of warhead-fuze combinations are available for the 70-mm rocket. Fuze types are available in nose-mounted or base-mounted models and are either electronically, mechanically, or electromechanically fired. These 70-mm fuzes include:

- o Remote-set fuzes for penetration of forest canopy, buildings, and bunkers.
- o Remote-set airburst fuzes.
- o Point-detonating fuzes.
- o Airburst, motor-burnout-delayed fuze.

Warheads for the 70-mm rocket include--

- o High-explosive, shaped-charged submunitions for antiarmor, antipersonnel, and antimaterial warhead.
- o Antiarmor (light armor), high-explosive warhead.
- o Flachete (2,500, 28-grain darts) antimaterial and antipersonnel warhead.
- o White phosphorus, smoke-screen warhead.
- o Illumination warhead.

The MK66-equipped rockets, with their improved rocket motors and warheads, are significantly more effective than the MK40 versions. The 70-mm rockets employed in DESERT SHIELD and DESERT STORM included both the MK40 and MK66 rocket motors. Apache units used all of the warhead and fuze combinations listed above in the Kuwait Thea+ of Operations. However, the quantities and cypes availa.le varied widely from unit to unit.

AIRCRAFT SURVIVABILITY EQUIPMENT (ASE)

Aircraft Survivability Equipment (ASE) systems for the Apache include infrared and radar jammers, radar-warning system, antiradar chaff, and an IFF transponder. The key to the Apache's survivability is a combination of ASE, low signatures, and tactically sound employment (Figure 7).

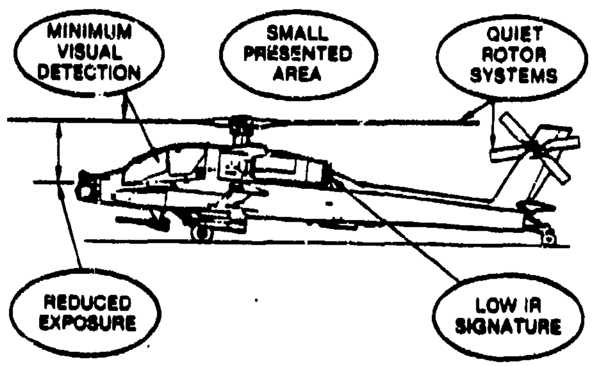

Figure 7. Aircraft survivability equipment (ASE)[7]

The Apache airframe has low visual, audio, and radar signatures. Its low-flicker main rotor and scissor-designed tail rotor reduces audible and doppler radar signatures. The Apache's design incorporates low-glint canopies, matte paint, and overall compact features. These measures also reduce the aircraft's overall visual signature. The Apache's engines embody sophisticated infrared suppression systems. Which reduce engine and exhaust temperatures to a point where they are no longer detectable by enemy infrared guided missiles. The Apache's low-signature design and exhaust-suppression systems combine to produce low-detectability signatures across the entire target-acquisition spectrum.

The IFF transponder system allows specially equipped surface forces or air forces to electronically identify friendly aircraft. The transponder uses an on-board cryptographic computer to produce special signals. When interrogated by a properly encrypted facility, the aircraft's transponder emits an encrypted reply signal. The encrypted reply signal validates the aircraft's friendly status (Figure 8). Changing the preset IFF computer codes daily prevents compromise and unauthorized use of reply codes. Line-of-sight and aircraft altitudes determine the effective range of the IFF system.[8]

A chaff system is employed by the Apache as an active, controlled, radar countermeasure. The system provides active survival countermeasures against radar-guided weapon systems. When an Apache crew identifies a radar-missile launch or that hostile radar systems have acquired the aircraft, they can fire one or a series of chaff cartridges which produce clouds of metallic chaff. The chaff cloud is used to decoy the radar threat away from the aircraft.

The primary radar warning receiver for most U.S. Army helicopters is the "APR 39." The APR 39 is a completely

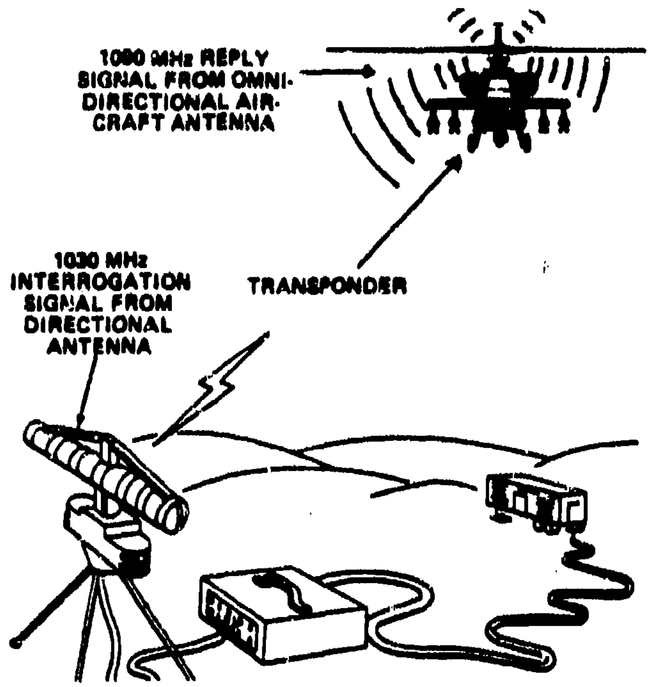

Figure 8. Identification friend or foe (IFF) system

passive, radar-emissions, detection system. This radar warning system detects most high-band and low-band radar emissions. The APR 39 system provides the pilot with both visual and audible displays. These displays reflect the aircraft's total radar environment. The APR 39 radar warning system indicates directional bearings to radar threats and the radar emitters strength. Newer APR 39 (V) digital radar warning systems annotate the display with alphanumeric data and identify the threat and its status. This digital system also provides a synthetic voice-warning to its crew.[9]

Before DESERT SHIELD, most army helicopters used the APR 39-pulsed detection systems. During DESERT

SHIELD, 1,200 deployed Apaches, Cobras, Black Hawks, and Kiowa scouts received the new APR 39 (V) digital, threat-warning receivers.

The AN/ALQ-136 radar countermeasures set provides the Apache with a radar-jamming capability. The system is an active/automatic radar countermeasure set. The AN/ALQ-136 provides the Apache with the ability to jam unfriendly radar emitters. The radar-countermeasures system receives and identifies pulsed-radar signals. When threatening radar signals are detected, the AN/ALQ-136 system automatically selects and transmits appropriate radar-jamming signals.

Many air-to-air and ground-to-air missiles are infrared-guided. The AN/ALQ-144, infrared-countermeasures set provides the Apache an infrared, missile-jamming capability. The system is an active on/off countermeasures set that generates infrared energy. The system modulates and projects infrared energy away from the aircraft to confuse infrared, energy-seeking missiles. Before the start of DESERT STORM, many Apaches received improved ALQ-144 jammers. These improved jammers were effective against a broad range of infrared-guided missiles.[10]

COMMUNICATIONS EQUIPMENT

The Apache's communications package includes UHF, VHF, and FM radio links. The KY-58 Vinson, FM-secure, and Have-Quick (UHF-frequency hopping), radio systems provide secure communications.[11] These systems operate on line-of-sight principles and have ranges of from 10 to 20 miles. Apaches deployed to DESERT STORM had Have-Quick II, UHF radios compatible with Air Force and Airborne Warning and Control System (AWACS) UHF systems. The Have-Quick II's frequency-hopping patterns are not compatible with the Have-Quick I systems installed on Black Hawks, Chinooks, and some Kiowa helicopters. The Apache's FM-secure radio is compatible with all standard U.S. FM-secure systems.

Because of the flatness of the terrain in the desert, line-of-sight and radio communications range is good. The increased distances associated with desert operations decreased the effectiveness of tactical-radio communications. The FM communications over these extended distances proved to be deficient, especially in the higher FM frequencies.

EXTENDED-RANGE FUEL SYSTEMS

Apaches have mounting points and plumbing provision on the stub-wing pylon stations. They can accommodate up to four, 230-gallon, auxiliary fuel tanks (Figure 9). These nontactical fuel tanks increase the Apache's deployability by extending its ferry range. With the auxiliary tanks installed, the Apache's ferry range increases from 350-nautical miles to more than 800-nautical miles.[12]

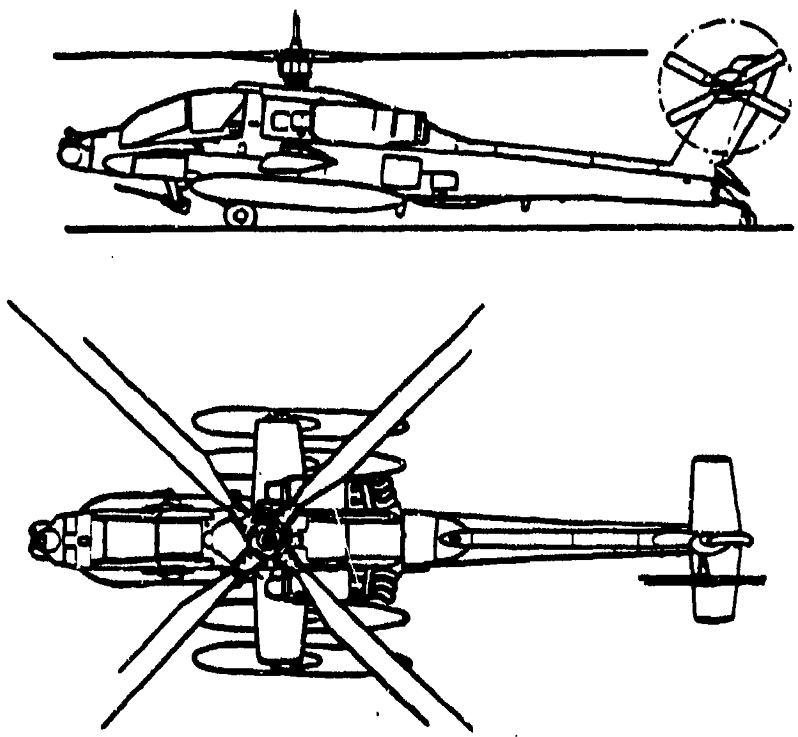

Figure 9. Extended-range fuel system

Apache units in Operation DESERT SHIELD and DESERT STORM altered standard aircraft load configurations to accommodate the extended ranges of their missions. Apache wing-store configurations routinely included at least one auxiliary fuel tank. Common external wing-store configurations included an auxiliary fuel tank mounted on the left inboard wing station. To counterbalance the weight of the auxiliary fuel, units mounted Hellfire launchers and four Hellfire missiles on the right inboard wing station. The 230-gallon auxiliary fuel wing tank received approval for tactical use in the Kuwaiti Theater of Operations. However, tactical use of the fuel wing tanks was only approved for use during DESERT STORM and DESERT SHIELD.

ENDNOTES

1. Rudolph Ostovich, III., "Army Aviation DESERT SHIELD/STORM After Action Report (AAR)" (June 1991): F1.

2. Philip J. Geddes, Apache: 49.

3. Ibid.

4. Ibid., 60.

5. Ibid., 65.

6. Ibid., 48.

7. Hughes Helicopters, Inc., "A Total System for Battle." (1986): 2.

8. U.S. Army technical Manual 55-1520-238-10 (June 1984): 3-46.

9. Ibid., 4-20.

10. Ibid., 4-26.

11. Ibid., 3-8.

12. U.S. Army Field Manual 1-111, Aviation Brigade (August 1990): I-2.

CHAPTER 3

DOCTRINAL EMPLOYMENT

A collection of flexible, commonsense ideas constituted the doctrinal guidelines for employment of attack helicopters on the modern battlefield. Field Manual 1-100, Army Aviation in Combat Operations,[1] states doctrinal employment guidelines as follows:

- o Fight as an integral part of the combined arms team.
- o Exploit the capabilities of other services.
- o Capitalize on intelligence-gathering capabilities.
- o Suppress enemy weapons and acquisition means.
- o Exploit firepower.
- o Exploit mobility.
- o Exploit surprise.
- o Mass forces.
- o Use terrain for survivability.
- o Displace forward elements frequently.
- o Maintain flexibility.
- o Exercise staying power.

The tenants of AirLand Battle Doctrine[2] and the principles of war[3] reinforce the execution of these attack helicopter employment principles. The tenants of AirLand Battle Doctrine require military forces to join and fight as a combined arms team capable of simultaneously conducting deep, close, and rear operations. Simultaneous operations impels the enemy to apportion his forces and fight in more than one direction at a time. The Apache helicopter is capable of conducting deep, close, and rear operations missions. Therefore, it is integral to combined arms teams.

During deep operations, the Apache can strike enemy forces and shape the battlefield before the enemy closes with friendly forces. During close battles, where enemy forces have closed with friendly forces near the forward line of friendly troops, Apaches can weigh the main effort and strike engaged enemy forces in depth. The Apache can also perform security operations in response to threats in the friendly rear area of operations. Apaches serve as a credible security force against both ground penetrations and large airborne or heliborne assaults into division or corps rear areas.

Doctrinal Apache employment seeks to exploit the capabilities of other branches and services. Employment take advantage of the strengths of other branches and services to offset aviation's vulnerabilities. As a member of the combined arms team, Apache helicopter units can benefit from the efforts of forward ground maneuver units and intelligence assets to identify and expose enemy forces. Effective joint mission planning integrates operations by other services and branches into mutually supporting J-SEAD missions and maneuver. The advantages of the combined arms team and joint missions require constant liaison and coordination with other branches and services to exploit their potential.

To be successful on the battlefield, Apache units must capitalize on Army all-source intelligence capabilities. Effective intelligence reports provide Apache units with knowledge of the enemy, weather, and terrain. Unit commanders rely on these reports in making decisions, issuing orders, and employing forces on the battlefield.

Apache-unique visionics and cross-FLOT missions provide Apache units with impressive intelligence-gathering capabilities. However, the majority of the raw intelligence acquired by forward apache elements requires analysis assets found only in specialized intelligence units which receive and consolidate intelligence data. Intelligence units provide finished intelligence products and intelligence updates to Apache units. These finished intelligence products aid commanders in determining appropriate courses of actions and tactical plans.

A key advantage in maneuver-oriented combat is surprise. Attack helicopter units often exploit surprise against enemy weapons and acquisition means by participating in mutually supporting attacks and missions. Apache units frequently depend entirely on other branches or services for suppression of enemy air defense (SEAD) supporting attacks.

Enemy air defense suppression consists of both active and passive suppressive measures. Passive measures include area avoidance, terrain flight techniques, minimum exposure routes, and employment of electronic countermeasures. Active measures include direct and indirect weapons employment against enemy air defense assets and related activities. Field artillery, intelligence and electronic warfare forces, U.S. Air Force, and direct-fire weapons systems provide or mutually support active suppression of enemy air defenses. Apache units routinely incorporate both passive and active means of providing SEAD in support of mission accomplishment.

The Apache's lethality extends the ranges of target engagements and destruction on the modern battlefield. Doctrinal Apache missions include destroying point targets, providing suppressive fires, or observing and directing indirect fires. Apache helicopters exploits firepower in several ways. They--

o Provide direct and indirect fires in offensive and defensive operations.

o Control fire-and-forget (smart) munitions for sister services and branches.

o Strike decisively at the enemy from any direction.

The Apache is unencumbered by terrain and ground obstacles. Its mobility gives it the ability to mass combat power anywhere on the battlefield. In exploiting this mobility, Apache units can quickly employ forces at critical decision points, counterattack enemy penetrations, or exploit enemy weaknesses.

Night and adverse weather employments enhance the Apache's element of surprise. Deception operations, coordinated with combined arms schemes of maneuver, further increase the likelihood of operational and tactical surprise.

Mobility is a key element in massing forces. Helicopters increase the rate of concentration and dispersal of combat power. Apache units achieve massing combat forces by employing its aerial maneuver capability to allow Apache units to strike the enemy at its weak points. Apache maneuverability can provide relentless combat power and can steal the enemy's initiative while exploiting its weaknesses.

Terrain provides cover and concealment for helicopters. Using terrain to reduce the aircraft's exposure to direct-fire weapons and target-acquisition radars enhances the Apache's survivability. Masking tactical movements also denies to the enemy combat-critical information about friendly maneuver and intentions.

Areas that Apache units occupy while awaiting orders to execute their mission are known as forward assembly areas. Unique communications and other signatures make Apache forward assembly areas and their attendant support resources increasingly easy to identify and target. Therefore, Apache units and their forward support elements must frequently displace.

Assembly area vulnerabilities increase with the proximity to the enemy's front lines and the amount of time a unit remains static. Typically, aviation resources re-position and disperse in areas outside the main battle area and beyond the range of enemy artillery. Only resources required to accomplish a specific mission displace forward to support the battle. The positioning and displacement intervals of the forward elements varies according to specific missions and enemy capabilities.

Common Apache missions concentrate on deep battle or close-fight operations. However, Apache units also perform rear-area security missions. In fact, nonlinear warfare environments and security operations are ideal for Apache units. In a nonlinear environment maneuver commanders can rely on the flexibility of the Apache's firepower and maneuverability to achieve surprise and to mass combat power.

Apaches exercise staying power by providing around-the-clock, but not long-term, operations in nearly all weather conditions. Detailed planning, coordination, and access to divisional-level and corps-level intelligence and support assets enhance the Apache's staying power.

Employment techniques range from small company and teams which provide continuous coverage of the battle area to battalion-sized mass attacks of short duration. Mission payoffs and risks determine the employment technique to use.

U.S. Army doctrine provides guidelines for Army aviation employment. A meaningful perspective of this doctrine develops from a knowledge of doctrine and its application in flexible, commonsense ways. "Doctrine provides the starting point for determining what is required."[4]

ENDNOTES

1. U.S. Army, Field Manual 1-100, Army Aviation in Combat Operations (February 1989): 1-16.

2. The tenants of Airland Battle are initiative, depth, agility, and synchronization. (See FM 100-5.)

3. The principles of war are objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, and simplicity. (See FM 100-5.)

4. U.S. Army, Field Manual 22-103, Leadership and Command at Senior Levels (June 1987): 11.

CHAPTER 4

TRAINING THE FORCE

The Apache's success as a combat multiplier depends on its air crews. The crews must be technically and tactically proficient in employing the aircraft. The competence levels of an Apache's combat crew is the deciding factor of overall effectiveness on any given mission. Army aviation has developed and promotes comprehensive training programs for Apache crews to increase their competence and aid them in withstanding the stress of continuous combat operations.

An Apache's combat crew can expect a multitude of factors to affect them in the accomplishment of their mission. Foremost is the intensity of the combined arms mission itself. Crews can expect to be employed as a strike force at the enemy's center of gravity[1] around which the fog of battle will be thick. The complexity of the Apache's mission systems makes its crew susceptible to distractors and side task-loading. The intensity of combat missions, combined with distractors and side-task loading, put even the most proficient aviators to task.

Theorist and planners continue to look beyond peace to formulate Apache training and employment strategies. These strategies include the wartime needs of units and soldiers and develops them into training schemes whose focus is on ensuring that Apache aviators are able to safely and effectively accomplish their demanding missions.

STANDARDIZATION

Apache battalions deployed to the Kuwaiti Theater of Operations participated in a nine-month, common-based, training program which enhanced the interoperability of common battle drills and promoted a coherent patterns of employment for Apache forces. These standardization training efforts continued throughout DESERT SHIELD.

XVIII AIRBORNE and VII corps established standardized desert-qualification training programs which helped aviators quickly acclimate to the desert environment. Each Apache unit experienced its own mission-unique training shortfalls. Therefore, desert-qualification training also served as a means to pass on lessons learned, and the increased emphasis on training and improvements remedied the majority of such shortfalls.

SIMULATION AND SIMULATORS

The Apache's success on the battlefields of Iraq was a direct result of effective training. DESERT SHIELD and DESERT STORM after-action reviews consistently place Apache units, crews, and leaders at a high state of combat readiness. Paramount to this readiness success was the extensive use of simulation and simulators in training. Simulators incorporated into Apache crew training included the cockpit weapons and emergency procedures trainer (CWEPT), a gunner's selective-task trainer, the combat mission simulator (CMS), and the aircraft survivability equipment trainer.

The CWEPT and the gunner's selective-task trainers provided crews with realistic hardware and simulation integration and rudimentary in-cockpit sensor views. These systems served as effective procedural trainers. Crews learned and rehearsed standardized cockpit procedures and became familiar with the symbols and associated controls on their displays. With procedural trainers, standardization and skill building occurred without expending limited "live Apache" resources.

Many units praised the army's simulation program for helping prepare them for the Iraqi combat environment. During training, Apache units "crammed as many crews into CMS periods as time and space allowed before deployment."[2]

The 12th Aviation Brigade deployed a gunner's selected task trainer to Southwest Asia (SWA) in the early stages of Operation DESERT SHIELD. The procedural trainer received wide use and was instrumental in maintaining crew proficiency in complex tasks and procedures.

The CMS is used to train Apache crews to battle realistic threat arrays in a combat environment. It is a motion-based, synthetic, flight-training system which integrates full aircraft sensor capabilities and applies them toward a total crew training concept. The CMS incorporates more than 10 visual image displays. Three television-like, "out-the-window" displays provide color scenes to each cockpit. CMS computerized programs impose up to 99 threat array targets on training crew members while simulating day, night, and adverse combat conditions. The Army currently has CMSs located in both European and continental U.S. (CONUS) facilities.

In October 1990, U.S. Army Central Command established a requirement for immediate AH-64 CMS training in Southwest Asia.[3] Swift and early success of DESERT STORM and the cessation of hostilities deferred the deployment of a CMS to Saudi Arabia.

The Aviation Survivability Equipment Trainer II (ASET II) is a computerized/interactive program designed to provide information on the capabilities and limitations of aircraft survivability equipment. CMS and ASET II training periods provide instruction in the procedural use and capabilities of aircraft survivability equipment.

AIRCRAFT SURVIVABILITY EQUIPMENT (ASE)

Training in the area of aircraft survivability equipment emerged as a major deficiency for army aviation. The deployment and preparation phases of Operation DESERT SHIELD confirmed a general lack of understanding and proficiency in the use of ASE equipment. Many survivability countermeasures manuals remain classified and are not readily available to unit trainers. Therefore, because of inexperience and training deficiencies, many aviators were not fully confident about their equipment or their ability to use the equipment during combat.

Post-DESERT STORM training recommendations suggest the establishment of a survivability equipment training officer. The duties of this officer would include assembling and maintaining a current library of all aircraft survivability equipment-related manuals. The survivability training officer would also serve as a resident subject matter expert (SME) and coordinate ASE-related training and maintenance.

ENVIRONMENT

Environmental conditions in the Kuwaiti Theater of Operations were both unique and extreme. The Arabian Desert programs provided many crews their first glimpse of desert aviation operations.

AERIAL GUNNERY

In the Kuwaiti Theater of Operations, aircraft operational readiness (OR) received top priority. In fact, the need to maintain high OR rates for the Apaches outweighed the crew's needs for live-fire aerial weapons training. For example, when the readiness rates of an Apache unit dropped below a predetermined rate or percentage, all Apache flight training, including weapons training, ceased for that unit. As a result of this policy, many Apache crews fared weeks without flying or conducting hands-on procedural training. Individual night system, target acquisition, and supporting skills frequently suffered because of a lack of continuity and sustainment training.

Unrealistic training plans, shortages of combat-oriented aerial gunnery ranges and training ammunition plagued many "home base" gunnery training programs. One unit reported "it had only three crews that had ever fired a Hellfire missile and no crews that had ever fired MPSM rockets or 30-mm high-explosive rounds."[5]

Apache units during DESERT SHIELD and DESERT STORM had access to several "in-country" aerial gunnery ranges. Most of these were improvised ranges and provided little more than bowling alley-type target arrays. Most of these ranges were authorized for day-use only and carried restrictions on usage of lasers and dud-producing ammunition.

Limited amounts of Apache training ammunition in the Kuwaiti Theater of Operations further restricted aerial-gunnery training. Low Apache combat ammunition stockages prohibited the use of combat ammunition for gunnery training.

Supportable ammunition consumption and resupply rates are known as controlled supply rates (CSR). The CSRs define daily resupply rates in terms of rounds per weapons system per day. In DESERT SHIELD and DESERT STORM the CSR for Hellfire missiles and MPSM rockets were both reported as zero.

Many Apache units requested permission to conduct Hellfire missile tests to measure the effects of wind, dust, and laser backscatter on desert Hellfire missile engagements. Despite a theater-wide shortage of Hellfire missiles, the 101st Airborne (Air Assault) Division authorized its units to fire six Hellfire missiles per Apache battalion.

The absence of resources, simulations, and the constrained use of local training areas degraded the gunnery skills of Apache crew members. The inability to sustain gunnery proficiency and systems training resulted in Apache crews having a general lack of confidence in their ability to proficiently engage targets in combat.

TACTICAL EMPLOYMENT

The principle focus of an Apache crew's peacetime training is the standardization of the its tactical employment techniques. Apaches are normally employed in tactical teams of three to five helicopters. Company commanders maneuver Apache teams to strike enemy tanks and armored vehicles sighted by friendly ground or air forces. The Apache company commander is primarily responsible for the employment of his teams and the conduct of the aerial battle.

Deliberate Apache missions normally consist of the following tasks or phases:

- o Movement to a forward assembly area for final mission sequencing.
- o Movement to a battle position and selection of firing positions.
- o Receiving a target hand-off from airborne or ground commanders.
- o Acquiring, identifying and engaging targets.
- o Reengaging targets from secondary or alternate battle positions.
- o Movement to forward area refueling and rearming sites to reconstitute the team.

o Movement to assembly areas or forward assembly areas for mission updates or to await sequencing.

AIRCREW TRAINING PROGRAM (ATP)

Apache aircrew training involves a highly structured ATP consisting of qualification, refresher training, training records, proficiency evaluations, and mission training. Apache ATPs focus on improving unit readiness, standardization, safety, and aircrew professionalism. The ATP provides standardization of procedures and practices and provides a base for every-day flights and combat-mission training.

The Apache unit commander can use the ATP as a tool to measure a crew's proficiency in relation to the unit's mission. A serious drawback to the ATP is its heavy reliance on documentation. Records become cumbersome and hard to maintain in field environments also, many of the ATP-specified training tasks lack resourcing and feasibility in combat environments. Several Apache units closed out their home-base ATPs and established ATP field files which served as the basis for qualification and mission-familiarization of replacement personnel and crews.

Many Apache units received unqualified replacements before deployment and during DESERT SHIELD. Unit training managers conducted ATP-required training and evaluations for these replacements. These proficiency evaluations often consumed most of a unit's limited training resources.

The ATPs apply to both combat and peacetime environments. However, the ATP combat provisions were not specific or realistic enough to provide adequate guidelines for combat training. Planned improvements to the ATP include combat-training guidelines which are simple and flexible. Future combat deployments will likely see the suspension of the program's documentation requirements.

SAFETY

Safety is a theme that permeates all aviation activities. Leaders must constantly weigh operational needs against the inherent risks of aviation missions. Approved standardized training programs help leaders align mission and safety requirements. These standardized training programs represent a collection of flexible common sense approaches to mission accomplishment and excellence in training. Leaders must apply safety and resource constraints to these standardized training programs and produce programs tailored to the mission requirements and needs of individual units.

The positive transfer of good safety habits preserves manpower and equipment during combat. In an environment of constrained resources and manpower, even one accident is too many. During Operation DESERT STORM, units that continued to abide by standardized procedures and routine safety checks performed their combat missions safely.

Every Apache unit deployed to Operation DESERT STORM experienced its own mission-unique training shortfalls and resource constraints on training continue to be formidable. Units must abide by these constraints and train within their means. Crews must build their experience base daily working on and improving individual and collective skills. Units must deploy to combat with the equipment at hand. The goal of mission training is to prepare crews for the violence of combat and to gain maximum use of the Apache and its systems.

ENDNOTES

1. U.S. Army, Field Manual 100-5, Operations, (May 1985) defines "center of gravity" which provide freedom of action and maneuver and a will to fight.

2. Rudolph Ostovich, III, "Army Aviation Desert Shield/Storm After Action Report (AAR)" (June 1991): 2-11.

3. Eric M. Routledge, Willia Lapham, and Charles Fullmer, "AH-64 Apache CMS Prepares for War," Army Aviation (November 1991): 44.

4. U.S. Army, Field Manual 1-202, Environmental Flight (February 1983): 2-3.

5. Ostovich: D-11.

CHAPTER 5

EXECUTION, PERFORMANCES, AND CONCLUSIONS

Apache attack helicopters and their crews fought decisive battles and survived on the nonlinear battlefields of Iraq. Execution and performance Apache crews in DESERT STORM in the operational categories of intelligence, maneuver, fire support, survivability, air defense, combat service support, and command and control show that although aviation's performance was outstanding, there are still areas in which more effective training would be of benefit.

INTELLIGENCE

Intelligence goals are to provide accurate portrayal of the battlefield resulting from the collection, evaluation, analysis, integration, and interpretation of all available information concerning an enemy force. This includes information about the geographical area of operations and specific capabilities and weaknesses of enemy forces.

> In the arena of conflict, there is no more valued commodity than good information. Any commander--of any military force--generally wants to know more than he can usually find out about the enemy . . .

> Divisional-level operations in DESERT STORM, even with all the media images of high-tech wizardry, were still largely immersed in the classic fog of war.1

The U.S. Army's operational intelligence network was not effective in providing up-to-date or real-time information to Apache combat crews during DESERT STORM. With only a few exceptions, Apache units conducted deep attack missions into Iraq with only limited intelligence. This limitation reduced the effectiveness of deep operations and significantly increased mission risks. Armed reconnaissance and contact with enemy forces provided many tactical commanders the only true pictures of target areas and battlefields.

Doctrinally, deep attack missions revolve around high value target (HVT) lists. These target lists require special processing, analysis development, and collection data refinements. The availability of these target analyses plays a pivotal role in mission analysis and risk assessment. During DESERT STORM operations, the HVT list rarely made the change from 20-hour-old to 60-hour-old planning data to real-time execution data.

The dispersion and the static nature of the Iraqi forces in Operation DESERT STORM made it difficult to locate and target viable targets. A priority target for intelligence collection is the location and disposition of enemy forces. Often collection focuses on forces not in the immediate battle area or which are being held in reserve. The general dispersion of Iraqi forces hampered the collection of this priority information.

Forward deployed Iraqi forces became organized and deployed in concentrated pockets and strongholds. These force concentrations left large gaps and fostered the potential for a nonlinear battlefield. In exploiting these force concentrations, the coalition force's air superiority produced decided advantages. Iraqi strongholds and concentrated forces presented lucrative targets for cruise missiles and air and heliborne attacks.

The use of Apache helicopters to attack HVT[2] in deep operations required precise intelligence and collection management. Effective command and control were essential if attack helicopters were to make use of available intelligence and reduce exposure to enemy weapons systems.

Attributes of DESERT STORM operations included highly mobile and fluid battlefield schemes. In such operations, old battlefield intelligence is of little use. The tempo of air maneuver and air attack operations require detailed, real-time information. Deep attack operations in these high-tempo schemes require extensive, dedicated intelligence and analysis resources. Attack helicopter units require real-time information to execute SEAD operations and to refine target engagements. Real-time intelligence updates on enemy activities in the target area is critical.

The lack of targeting data in DESERT STORM operations forced Apache commanders to forego the surgical strike nature of deep operations. The Apache employments centered on movement-to-contact and search-and-destroy tactics. These tactics resulted in the exchange of predetermined, planned engagement areas for dedicated search and engagement zones.

Force commanders made up for the shortfalls in real-time intelligence by requesting and employing aviation reconnaissance resources. Commanders sent Apache-escorted scouts and Apache-pure teams deep into Iraq to gather intelligence data. Reports state, "Force commanders, presented with volumes of intelligence information, considered the information secondhand unless confirmed by Army aviators."[3] In addition, Apaches provided security for long-range surveillance team insertions and extractions. Using Apaches to fill these intelligence-gathering gaps reduced the overall combat availability and power of Apache attack helicopter battalions.

Apache commanders demonstrated a marked ability to adapt employment doctrine to a changing environment and requirements. This ability reflects favorably on their units, training, and professional abilities. Apache units readily adapted to the role of providing intelligence data and performing data verification. The ability of aircrews to accurately relay battlefield information provided pivotal force actions during the air and ground campaigns.

Often reconnaissance information required immediate analysis and handling by Apache aircrews. Force commanders commented that Apache crews provided them with accurate intelligence reports. In these reports, Apache crews did not report numbers and types of vehicles, but identified enemy forward detachment and reconnaissance elements, offensive formations, and defensive belts.

Deep attack missions well suit Apache helicopter battalions. However, successful accomplishment of such missions requires the dedicated targeting support of a combined arms team. Apache units must coordinate with divisional and corps intelligence managers to--

- o Clarify questions for the aviation commander.
- o Refine information requests.
- o Prioritize requests.
- o Construct a plan to answer requests and apply the information.

The failures of intelligence at the tactical-unit level were similar to the disaster at Pearl Harbor. The similarities revolve around "the failure of the Army and Navy in Hawaii to make their fight with the equipment at hand--it was not that they had no equipment, for they did, but they did not utilize what they had."[4]

DESERT STORM tactical missions did not routinely take advantage of all-source intelligence available to division and corps intelligence collection managers. Tactical unit planners and commanders must actively participate in collection management. They must determine what their units need for war and aggressively seek focused, multidisciplined collection management and distribution programs to meet those needs.

XVIII Airborne Corps orchestrated one of the many successful real-time intelligence operations providing Apache crews with updated targeting and threat assessments. The operation involved an Apache battalion from the 12th Aviation Brigade, French heliborne side-looking airborne radar (SLAR), and XVIII Airborne Corps intelligence analysts.

On 18 February, 1991, Apaches from the 12th Aviation Brigade conducted night combat operations near As Salman Airfield to engage Iraqi armor elements and convoys. A French heliborne SLAR (prototype SLAR) provided the Apache potential target cues and identification corroboration. Targeting information was down-linked from the French helicopter to intelligence analysts at XVIII Airborne Corps main headquarters. Apaches launched to intercept the Iraqi targets only after receiving target validation and approval to execute the mission from corps headquarters.

The uppermost success of the operation was the setting up of a real-time information link with an allied force's primary intelligence network. The limited range of the prototype SLAR did not provide adequate targeting for deep attack operations. Apache teams and the SLAR aircraft did not set up direct communications links. This lack of direct communications inhibited the SLAR's ability to vector the Apaches to targets.

MANEUVER

The principles of war define maneuver as "the movement of forces supported by fire to achieve a position of advantage from which to destroy or threaten destruction of the enemy."[5] The mobility of attack helicopter units permit commanders to affect the enemy's maneuver by applying combat power across otherwise untrafficable terrain.

Apache helicopters were successful in performing and influencing operational and tactical maneuver on the battlefields of DESERT STORM. Force commanders integrated Apaches in the scheme of maneuver by assigning them missions along the full width and depth of corps and divisions operations. Apache battalions directly supported operational maneuver by conducting attack, reconnaissance and security, air assault, and special operations missions.

> The speed and depth of combat operations during DESERT STORM should renew interest in achieving a new dimension of land warfare where the centerpiece of the combined arms organization is the attack helicopter battalion.6

Inclement weather was a major factor in the days immediately preceding the coalition's ground offensive. Visibility was often less than 2 kilometers (km), and ceilings were from 500 to 1,000 feet. The poor weather and high battle tempo combined to force commanders to make thorough METT-T in their mission analysis. The commanders applied mission analysis and risk assessments in developing their employment principles and doctrinal decisions.

The use of Apaches by force commanders lends precedence to the adage "offense is the best defense." The Apache battalion's speed and flexibility in applying combat power kept pressure on Iraqi forces. Apache employments included deep-attack and close-attack operations. Employments in the VII Corps' area of operation typified force commanders reliance on Apaches. VII Corps' Apaches operated in a cold rain, 20 kilometers in front of 1st Armored Divisions forward units. Crews reported that the rain made the thermal images stand out and allowed extended-range target engagements. These missions gained and kept the initiative.

Apache battalions also played a primary role in providing reconnaissance and security for Operation DESERT STORM. The missions ranged from covering-force missions to nightly armed border patrols. The Apaches received these reconnaissance missions because of their ability to work at night and in adverse weather. High winds, poor ambient light conditions, and night-vision goggle safety restrictions hindered the employment of Army scout aircraft on several pre-G-day intelligence-gathering missions. Apaches from both XVIII Airborne and VII Corps flew successful deep, zone, and route reconnaissance into Iraq. Apache contributions to reconnaissance and security allowed force commanders to react quickly to situations and execute missions at the minimum acceptable risk.

Apache helicopters provided air assault security as part of the 101st Airborne Division (Air Assault) air assault task forces. Air assaults performed in DESERT STORM represent the largest air assault operations in history and was a complete success. Aerial security provided by attack helicopter units allowed force commanders the flexibility to exploit Iraqi weaknesses with air mobility at minimum risk.

Apache and special operations units joined forces to conduct D-day J-SEAD operations on key enemy radar positions deep in Iraq. These "Army Apaches fired the first shots that kicked off Operation DESERT STORM."[7] This J-SEAD operation was largely responsible for disrupting and neutralizing Iraq's air defense system. Apache support for special operations, long-range surveillance team included insertions and extraction escort missions.

The environment and tempo of DESERT STORM required a large degree of flexibility from unit leaders and Apache flight crews. Although Apache units constantly found themselves trying to catch up to the war's pace, leaders were able to synchronize the operational requirements of DESERT STORM missions. In addition, "Leaders at every level displayed their preparedness.... Leaders and soldiers were confident in their own abilities and those of their superiors."[8] The technical and tactical proficiency of Apache units and their leaders led to notable successes in the campaign.

Standardization and collective training enhanced the flexibility of employment for Apache units. Attaching an XVIII Airborne Corps Apache battalion to the 101st Aviation Brigade was a sterling example of the capabilities of standardized units. Within three days of attachment, the Corps' Apache battalion went into combat as a divisional asset. The unit conducted joint combat operations with no significant operational or procedural problems.

Units received authorization to alter the Apache's tactical load configurations to accommodate the extended ranges of desert warfare. The units installed the 230-gallon auxiliary fuel wing tanks for tactical use which significantly extended the unit's mission ranges. Wing tanks allowed XVIII Airborne Corps Apache units to perform tactical missions with durations of from 3.5 to 4 hours.

This also extended the coalition force's ability to project firepower deep into Iraq.

Crew reports cited outstanding performances for the auxiliary fuel systems. Crews noted only slight problems with the rocket launcher pod's ability to elevate when mounted opposite the wing tank. Several after-action reviews also noted noticeable "fuel sloshing" in the auxiliary fuel tanks which caused reduced maneuverability.

The Apache's extended deep-attack capabilities depends on external fuel. DESERT STORM confirmed the need for external fuel tanks. Risk assessment for future long-range tactical employments must consider the effects of wing tanks on weapons systems and the maneuverability of the aircraft.

FIRE SUPPORT

Fire support is the collective and integrated use of target acquisition and direct and indirect fire weapons. The goal of the fire support network is to synchronize every available target acquisition, weapons systems and control facility to attain the most effective target coverage.

Operation DESERT STORM Apache units provided maneuver commanders excellent operational-level fire support. The execution of Apache missions enhanced force commander's scheme of maneuver by destroying, neutralizing, and suppressing enemy weapons, formations, and facilities. Apaches demonstrated an ability to provide fires throughout the battlefield. This mobility and its effective integration into the combined arms team allowed the Apache to become the decisive fire support asset during the pursuit phases of Operation DESERT STORM.

The joint air attack team (JAAT) was the most common combined arms fire support mission performed by Apache helicopter units. "Day and night and both preplanned and spontaneous JAATs were conducted in DESERT STORM; all were successful."[9] Most JAAT employments occurred during the corps' deep battle and were well out of artillery range. These targets required direct-fire weapons because of target dispersion and fortification. So, the Apaches and Air Force close support aircraft became primary JAAT players.

Corps and division operations routinely synchronized Apache weaponry, acquisition, and control systems with the entire combined arms team. Examples of the divisions' ability to synchronize Apaches into their fire support scheme include the extensive use of Apaches in the battlefield intelligence and counter-intelligence systems and SEAD and security operations.

At the execution level, the Apache weapons systems met or exceeded expectations. Reviews on Hellfire missiles and 70-mm rocket systems consistently praised performance and reliability. Reports on the 30-mm cannon stated that it was lethal and accurate but not dependable.

Mark 66 motors and multipurpose submunitions warheads proved effective against light armor and were a favorite among Apache crews. The range, accuracy, and fire power of this 70-mm rocket combination is a considerable improvement over earlier versions of 70-millimeter rockets. (A 70-mm multipurpose rocket received credit for the destruction of a T-55 tank.)

The environment did have an effect on the employment tactics of the 70-mm system. High-explosive warheads proved to be less effective in the desert because of the sand dissipating the explosive force. The extended targeting and acquisition ranges of the desert exceeded the range capabilities of Mark 40 motored rockets.

Excessive exposure to sand and dirt often caused the 70-mm rockets to become jammed in the launch tubes. Sand and corrosion on 70-mm firing leads also routinely blocked electrical firing connections. The loss of electrical connections resulted in degraded performance of the aircraft's rocket-management system, misfires, and erroneous inventory status messages. Crews combatted these problems by covering and protecting the rockets and the launch pods from the environment when possible.

The Hellfire missile performed according to expectations and is an essential link to the Apache's success in DESERT STORM. An example is the battle damage assessments (BDA) of an VII Corps Apache battalion. The

Apache battalion reported more than 170 tanks and armored vehicles destroyed in one deep-attack mission. "A note to this accomplishment is that it took Air Force A-10s a week and hundreds of sorties to accomplish the same BDA."[10] The weapons system of choice for these crews was the Hellfire missile. The missile's ability to engage and destroy targets at stand-off ranges made the Apache a lethal desert combat system.

The Hellfire missile's role in DESERT STORM expanded from a purely antiarmor role to one that included employment against bunkers, viaducts, and hardened targets. Hellfire missile engagements also supported combined arms and joint service operations against Iraqi command and control facilities and bridges. In the "D-day Apache raid," Hellfire missiles destroyed a key Iraqi air defense complex and made Iraq defenseless to coalition air attacks.

Performance samplings of 200 Hellfire missile combat firings show that 127 missiles (63.5 percent) hit and destroyed their intended targets. Only 73 missed.[11] A sampling of six Apache battalions revealed Hellfire "probability of hit" percentages ranging from a low of 60 percent to a high of 96 percent.[12] Both surveys reported that the Hellfire was extremely lethal. "All targets engaged by the Hellfire, to include the new sophisticated armor systems, were easily destroyed when hit."[13]

Factors affecting the missile's probability of hit percentages included target obscurement by combinations of rain, fog, dust, and smoke. Blowing sand produced dust clouds that scattered and reflected laser energy which detracted from the Apache's ability to designate and engage targets at maximum stand-off ranges.

Crews reported increased difficulties in acquiring and engaging targets in the final hours of DESERT STORM. During that time, the ambient air temperature and dew-point spread became small, causing the A-model Hellfires to leave clouds of smoke when departing from the aircraft. These smoke clouds were enough to cause the crew to lose contact with the missile. Running fire and using C-model, minimum-smoke missiles dissipated and overcame this problem.

To offset the effects of blowing sand on target laser designations, pilots chose a mode of engagement that delayed initial target designation. This mode reduced the chances of the missile queuing on back-scattered or reflected laser energy. The drawback to this mode is that it provided the missile with minimal terminal guidance commands, reducing the missile's probability of a hit.

Another problem affecting Hellfire missile performance was sand particles scratching and pitting the missile's optical nose cone which, in turn, obstructed the missile sensor's vision and prevented it from picking up the laser target designation. Sand, dirt, and small stones lodged in the missiles stirring fins and canards caused them to stick in flight. Adopting a daily maintenance and cleaning routine reduced the effects of the dusty environment.

Apache missions in DESERT STORM effectively supported the coalition's exploitation of Iraqi forces and prevented them from reorganizing a defensive system or from conducting an orderly withdrawal. These missions placed Apache crews on the enemy's flank and rear areas, operating in movement-to-contact and search-and-destroy roles.

The unrehearsed nature of movement-to-contact and search-and-destroy missions places increased demands on the aircrew to respond to targets of opportunity and unforeseen events. After-action reviews of these missions included Hellfire engagement video film and pilot interviews. Review of the material revealed a trend of time-consuming technical errors and poor procedural standardization among some of the crews. The tapes revealed that these crews spent increased amounts of time in acquiring, identifying, and engaging targets.

> In one unit, the average time spent in battle positions was 20 minutes. This unnecessary exposure could have proven fatal in a more hostile environment and may cause a negative training carryover for future engagements.14

Difficulty in identifying targets from extended ranges and concerns of fratricide attributed to much of the protracted engagement times. However, reducing switchology errors and improving crew drills increases the aggressiveness and fury with which Apache crews attack future targets.

DESERT STORM confirmed the 30-mm cannon problems identified in previous operations and exercises. The 30-mm cannon experienced significant jamming problems caused by--

- o Sand ingestion.
- o Jammed weapon-feed mechanism.
- o Lose fuzes on 30-mm cartridges.
- o Weapon drive-motor seizures.
- o Broken ammunition-carrier chains.
- o Stretched ammunition-feed chutes.

Reducing ammunition loads by 50 percent (from 400 to 600 rounds) and decreasing preventive-maintenance intervals reduced gun jams. However, "even with intensive preventive maintenance and reduced ammunition loads, pilots could not be confident that the system would work when it was needed."[15]

In some cases, the 30-mm cannon performed dependably and effectively. But its reliability varied by unit and even airframes within units. When accurate and able to fire, the 30-mm cannon was lethal and destroyed targets out to 4 kilometers. Investigations on battle-damaged Iraqi tanks revealed that the rear portion of a T-72 tank was penetrated by Apache 30-mm, high-explosive, dual-purpose rounds.[16]

SURVIVABILITY

Survivability includes operations to reduce susceptibility to detection and to reduce vulnerabilities to the effects of enemy weapon systems.[17] Aircrew survivability on the modern battlefield depends on many interrelated factors. The ability of organic air crew survivability equipment to enhance Apache survivability compounds when incorporated into detailed mission analysis and planning and risk assessments. Unfortunately, the tempo and exploitative nature of DESERT STORM missions allowed neither detailed mission analysis nor planning.

Most Apache night or adverse-weather employments required the use of reduced engagement ranges. Although Apaches have near all-weather capability, low visibility reduces the range at which they can acquire and engage targets. With reduced contrast between the target and the target's background, the Apache's night-vision devices' range capabilities degrade. The extent of the range reduction depends on the amount and mixture of moisture and obscurities in the air. Reduced acquisition and identification ranges in DESERT STORM required the Apaches to close to within 2 to 3 kilometers for night engagements. Those ranges placed the Apaches within range of enemy direct fire and small-arms fire.

Reduced engagement ranges and lack of detailed mission analysis placed increased reliance on aircraft ASE for mission success and crew survivability. However, Apache crews voiced a lack of confidence in the capabilities and limitations of ASE. Many aviators expressed doubts in their ability to use ASE systems in combat because of recent equipment upgrades and their own inexperience and training deficiencies. Confidence in ASE warning systems declined as the system bombarded crews with erroneous cues and warnings.

Because Iraqis did not employ sophisticated electronic, radar, and microwave systems in DESERT STORM, allied transmissions and emissions exclusively filled the battlefield. Yet, Apache electronic countermeasures warning receivers and missile detectors routinely gave threat warnings and signs of threat radars tracking and locking onto the aircraft. Crews reported that emissions received from Hawk and Patriot missile batteries would activate radar and missile alert audio warnings. The lack of accuracy in the ASE system degraded its effectiveness and hampered mission accomplishment. Thus, DESERT STORM missions which placed a heavy reliance of ASE for mission accomplishment placed crews and equipment in high-risk situations.

Overall, the survivability designs of the Apache received much praise during DESERT STORM. The average flight time for the 100 hours of DESERT STORM was 32 combat hours per aircraft.[18] During the missions, several Apaches received battle damage, but only two Apaches were lost. Friendly forces recovered the crews from both. These accomplishments attest to the Apache's ruggedness, crashworthiness, and reputation as an "exceedingly hard" helicopter.

AIR DEFENSE

> Air defense is effort specifically intended to nullify or reduce the effectiveness of the attack by hostile aircraft or guided missiles (after they are airborne) to a level permitting freedom of action to friendly forces of all types.19

To be successful on the battlefield, combined arms force missions must include coordinated and synchronized air defense measures. One way to coordinate and deconflict the activities of multiple airspace users is to use positive and procedural control.

Positive control is the reliance on an electronic link to identify and control airspace users. The IFF transponder system is this link for the Apache. However, VII Corps reported a high failure rate of its IFF transponder systems. For example, an air defense unit in the VII Corps area of operation reported that 20 percent of the army helicopters interrogated did not reply with the proper encrypted signal.[20]

The ability of coalition forces to maintain air supremacy in the Kuwaiti Theater of Operations reduced the significance of these IFF problems. If Iraq had employed an aggressive air campaign, inoperative aircraft IFF systems would have undoubtedly led to incidents of fratricide.

Procedural control is the reliance on prearranged and disseminated rules and instructions to guide the actions of friendly airspace users. Aircraft that do not abide by or are not aware of the procedures become suspect.

The nonlinear battlefield of DESERT STORM required establishing procedural controls to deconflict joint offensive operations and air defense procedures. Procedural measures included specified air corridors and routes, weapons-free zones, restricted access areas, altitude restrictions and time slots. The purpose of these measures was to--

- o Reserve airspace for specific airspace users.
- o Restrict actions of airspace users.
- o Control actions of specific airspace users.
- o Require airspace users to accomplish specific actions.

The Army Airspace Command and Control (A2C2) section for both corps received approval for numerous procedural control measures in their areas of operations. Each control measure consisted of specified boundaries, altitude restrictions, effective times, and identification measures. (Approved control measures require timely dissemination to all appropriate elements of the combined services.)

To be effective, procedural control measure must be flexible enough to react to changes in the tactical situation, and friendly forces must abide by the established procedures. During DESERT STORM, the tactical aircrews did not always abide by nor receive procedural control measures. Short response exploitation missions and ever-changing airspace requirements degraded the effectiveness of procedural control measures. Units that did not receive updated procedural control measures conducted operations on the principle of "see and be seen." A lack of information-dissemination and utilization rendered procedural control measures ineffective as a means of synchronizing airspace usage and of determining aircraft friend or foe statuses.

COMBAT SERVICE SUPPORT

"Combat Service Support (CSS) is the assistance provided to combat forces in the fields of administration and logistics."[21] CSS includes administrative, maintenance, and logistical services.

When speaking of the maintenance and CSS challenges of Operation Desert Storm, Major General Robinson stated,

> In the broadest terms, we learned that many accepted peacetime procedures and structures were inadequate in wartime. The logistic strain of supporting a large aviation fleet in a contingency taught us new ways of doing business, and provided insights to the direction of the future.22

CSS was a success in DESERT STORM. Sound service support organizations and the ingenuity and commitment of the aviation soldier formed the basis for successful combat and CSS operations. "DESERT SHIELD/STORM unquestionably validated the current family of aircraft and aircraft equipment."[23]

Preceding Operation DESERT STORM, Apache units had performed well for months in the harsh Arabian Desert environment. During Operation DESERT STORM, the Apache proved itself reliable and maintainable. "Unit commanders and aircraft crews were extremely pleased with the lethality, survivability, and reliability of the AH-64, Apache, helicopter."[24]

> Through the entire operation, Apache mission capable rates (ORs) exceeded 90 percent, far above the Army standard. This again, is a tribute to the conscientious maintenance efforts of the aircraft crews and their supporting maintenance units, as well as the reliability of the system.[25]

Reports indicate that Apaches suffered few serious systems failures. Erosion of engines and rotor blades and the effects of high temperatures, corrosion, and ultraviolet radiation posed the most serious effects of operating in the Kuwaiti Theater of Operations.

Increased corrosion caused by the desert's low night time temperatures presented a problem. Condensation, resulting from 70-degree temperature fluctuations, caused a distinctive increase in aircraft component corrosion. Sand on and in the helicopter trapped moisture and further increased the corrosion problem. The Apaches required daily cleaning to combat these conditions.

Strong winds, often preceded by sharp temperature changes, compounded the problems of sand and dust accumulations. Ordinarily, desert winds die down around sunset for an hour or two then rise again. Sunrise brings a corresponding calming of the desert winds.

Apache crews found that wind-blown dust and sand penetrated and collected inside almost every crack or crevice on the Apache. Flying and hovering in and around loose sand and dust also produced excessive wear such as pitting and erosion of rotating and exposed parts. Even small volumes of loose sand and dust created serious erosion problems on Apache rotor blades, turbine compressors, windscreens, and computer components.

Aircraft support crews and support units went to tremendous effort to ease these adverse effects. For example, Apache crews adapted several modified flight techniques to reduce prolonged exposure to equipment-damaging dust and sand. Crews avoided hovering at low speeds whenever possible. Tailored takeoff and landing techniques got the aircraft airborne and landed with the least possible exposure to dust clouds and the hazards they presented. Several Apache units authorized changes to standard aircraft "run up procedures" to allow air crews to delay the activation and testing of nonessential mission equipment until well after takeoff so they would be clear of the dust clouds created by takeoff. For example, adaptations of the health indicator tests allowed crews to delay tests until well clear of blowing sand and dust.

Besides the formidable challenge of operating in a harsh environment, routine and combat Apache missions required large amounts of sustained logistic support. Actual support requirements varied, depending on environmental and mission requirements. Typically, employed Apache units required fuel and ammunition resupply from every 1-1/2 to 3 hours. The success of most Apache combat missions depended on integration of fuel, ammunition, and aircraft maintenance into the tactical plans. In DESERT STORM units successfully attached maintenance support teams to forward area refueling points. This flexibility allowed teams to perform minor maintenance repair well forward in the battle area. This forward fixing allowed the aircraft to remain in the battle and to conserve combat power.

The austere manning levels and the force structure of the aviation organization was an area of deep concern.

> The lack of robustness in the force structure hindered units' ability to operate up to their full potential in a combat environment, 24 hours a day for an extended period. Some of the major issues voiced were the shortage of redundancies in key MOSs, especially in the maintenance area; inadequate crew-to-aircraft ratios; shortage of personnel to man multiple FARPs; and staffs that

fell short of the size and capability of their infantry, armor, and field artillery counterparts.26

Apache units did well despite some inadequate manning because of the untiring efforts and professional devotion of soldiers and leaders. Many units were overstrength in both personnel and equipment, and other units received force augmentation once they arrived in theater. However, even with additional personnel and equipment, battalion and brigade staffs could not cover long-term, 24-hour operations.

Normally, Apache units receive pilot allocations on a ratio of one pilot per aircraft seat. This ratio "effectively reduces the aircraft availability to eight flying hours per day (less under strenuous conditions such as night systems flying)."[27] During DESERT STORM, an increased pilot-to-seat ratio could have considerably increased the average availability and flight time per aircraft.

Army wide force reductions will only worsen Army aviation structure inadequacies. Considering the lack of robustness that now exists in aviation units, the Army will have to make difficult decisions in addressing expanding roles and future structures of Army aviation.

COMMAND AND CONTROL

Command and control is the process of directing, coordinating, and managing combat forces to accomplish the assigned mission. The process includes personnel, equipment, communications, facilities, and measures necessary to assemble and analyze information and to supervise the execution of operations.[28]

Missions which took full advantage of the Apache's speed and flexibility stretched aviation command assets thin. Factors that adversely affect command and control over combat missions include lean force structures, poor communications, and a nonlinear battlefield.

In exploiting Iraqi strongholds and force concentrations, coalition forces created a nonlinear battlefield. Considering that most Apache missions centered on movement-to-contact and search-and-destroy tactics, pursuit operations on a nonlinear battlefield posed explicit concerns over possible fratricide.

> At 12:15 a.m. on moonless Feb. 17, the First Infantry's headquarters radioed for an Apache attack on enemy vehicles reportedly approaching a U.S. column of armor.... He [LTC Ralph Hayles] sent two Hellfires on a six-second flight into a Bradley fighting vehicle and an M1-113 armored personnel carrier, each carrying four [U.S.] soldiers.[29]

With the prospect of friendly fire and threats of court martials for pilots who committed fratricide, Apache crews sought visual identification of targets before engagements. Visual identification at night and in adverse weather required crews to close to within 2 to 3 kilometers of suspected targets to identify vehicles as friend or foe. Positive identification requirements kept Apache crews from using maximum stand-off ranges for battle positions within positive vehicle identification range. These battle positions put Apaches firmly within the reach of enemy air defense systems and in high-risk situations. "In future conflicts with a more aggressive enemy, these methods will be costly."[30]

> Theater attempts to identify friendly vehicles included taping them with inverted Vs, red cloth, IR tape and using colored lights, but none of these can be seen with FLIR at night. As a result of the possibility of fratricide, crews went to unbelievable lengths to ensure that targets were the enemy. These measures included flying close to the target to verify...and overflying targets to positively identify them.[31]

Fratricide resulted from failed command and control. Strained communications systems and lack of coordination between units often leave officers out of touch with the battlefield. Improved communications, liaison networks, and battlefield intelligence would enhance command and control on the battlefield and allow Apaches to employ their superior night-fighting capabilities in low-risk, high-payoff employments.

Apache communications equipment suffered major shortcomings in Operation DESERT STORM. Deep exploitation missions strained every communications system available. Apache teams operating across extended distances routinely operated for hours without communications with higher headquarters. These units operated solely under the direction of mission orders without benefit of current or updated information.

Long-range communications equipment, such as high frequency (HF) and tactical satellite (TACSAT) radios, met with some success. However, distribution of these systems at the tactical level was limited or nonexistent.

Operation DESERT STORM Apache communications issues included:

- The attenuation of Apache radio transmissions in certain directions because of the location of the antennae on the airframe.[32]
- Apache radios not being fully compatible with ground force units (except FM).[33]
- Interoperability problems between the Have Quick I and Have Quick II versions of UHF radios.
- The limited range of Apache communications systems.

CONCLUSIONS

Recommended actions to help alleviate the problems listed here include accelerating fielding of modern communications systems and installing HF and high-powered radios on Apache helicopters. Aviation's lean force structure hits squarely on the ability of attack helicopter brigades and battalions to conduct operations. The staffs of these units must plan and execute deep-attacks, close battle, and rear area security operations 24 hours a day. In addition, the current battalion force structure assigns primary staff aviators as pilots in combat operations. Having austere staffs limited units' ability to conduct continuous planning or effective liaison with supported units. In turn, the limited ability of units to plan future operations and react to present operations limited the Apache's combat power and its ability to influence the battlefield.

> One of the emerging observations from Operation DESERT STORM is that "We fought like we trained . . . and it worked." The Army training strategy, followed for more than a decade, paid great dividends on the battlefield. As we look to the future, the perspective of recent battle and the challenges of the new strategic environment must be combined to influence how we think about training for the remainder of this decade and into the next century.34

When faced with the shock of combat, many Apache crews were momentarily at a loss. They then relied on training and standardized procedures to carry them through. This training and standardization, made possible by visionary leadership, professionalism, and superb equipment, was responsible for the success of Army aviation and its contributions to the war.

However, many Apache crews deployed to the Kuwaiti Theater of Operations were not technically and tactically proficient. This lack of proficiency placed the aircraft and crew at high risk. Trainers must realize that complex aircraft, high-intensity mission schemes, and fleeting skills have the potential to form fatal combinations. Therefore, the visionary leadership who gave us the dynamic tactics and doctrine of Army aviation must focus on restructuring training.

Future training programs must account for the effects of budget reductions and reduced resources on training. Limited flight hours, training aids, and scarce opportunities for hands-on training cause combat crews to become increasingly susceptible to losing skills to disuse and interference.

Individual-training and collective-training programs need to revolve around low-cost, low-tech training which focuses on maintaining a level of training requisite to the missions that combat crews must accomplish. Flying and fighting the Apache helicopter cross-FLOT, using night-vision systems, in a high-intensity environment is difficult. Aviators' combat skills must become as second-natured as driving a car is to most of us.

To achieve and maintain higher levels of proficiency, aviators and trainers must make a commitment to excellence. Aviators need to reevaluate their ability levels, and trainers and aviators must work to develop and maintain a strong interest in professional competence to overcome training distractors. Visionary leaders must insist that being "good at it" will not be good enough for tomorrow's combat missions. They must also recognize that combat crews have a right to training standards and programs that will assure their survival on the modern battlefield.

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APPENDIX A

CHRONOLOGY OF DESERT SHIELD AND DESERT STORM

1990

Aug 2 --Iraq invades Kuwait.

Aug 6 --Saudi Arabia requests U.S. assistance in its defense.

Aug 9 --Lead army elements from the 82nd Airborne Division arrive in theater.

First 15 Apaches arrive in theater.

Aug 10 --First fast sealift ship (FSS) reaches Savannah and begins loading.

Aug 13 --First ship (FSS Capella) departs Savannah, 24th Infantry Division (Mechanized) equipment.

Aug 14 --82nd Airborne Division Ready Brigade-1 completes arrival of personnel and equipment in the Kuwait theater of operations and moves to secure ports.

Aug 22 --Presidential Executive Order 12727 authorizes first use of 200K Selected Reserve call-up and limited implementation of stop loss program. [1]

1990

Aug 23 --Secretary of Defense authorizes call-up of 25,000 Army National Guardsmen and Army Reservist in combat support and combat service support units.

Aug 27 --First FFS arrives in Saudi Arabia and begins offloading.

--First M1 Abrams tanks arrive in theater.

Aug 29 --82nd Airborne Division closes[2] in theater.

Sept 12 --Major combat elements of 24th Infantry Division (Mechanized) close in theater.

Sept 27 --101st Airborne Division (Air Assault) relieves the 82d Aviation Regiment as the front line defense. 82d Aviation Regiment assigned to protect oil fields near Abqaiq.

Oct 6 --101st Airborne Division (Air Assault) closes in theater.

Oct 22 --1st Cavalry Division closes in theater.

Nov 8 --VII Corps and 1st Infantry Division alerted for deployment.

Nov 13 --Presidential Executive Order 12733 extends Selected Reserve call-up to 180 days.

Nov 14 --Secretary of Defense increases Army Selected Reserve call-up authority to 80,000 and authorizes call-up of Reserve Component combat units.

1990

Nov 21 --VII Corps units begin deployment to Saudi Arabia.

Dec 1 --XVIII Airborne Corps closes in theater.

Dec 6 --First ships carrying VII Corps equipment arrive in theater.

1991

Jan 15 --U.N. deadline for Iraqi withdrawal.

Jan 17 --Operation DESERT STORM begins (D-Day).

--Apache unit from the 101st Airborne (Air Assault) Division destroys key enemy radar positions in concert with a J-SEAD operation, opening the door for a successful air campaign.

Jan 20 --XVIII Airborne and VII Corps begin movement to forward assembly areas for the ground phase of the campaign.

Jan 30 --Apaches from the 24th Aviation Brigade begin nightly armed border reconnaissance.

Feb 3 --XVIII Airborne and VII Corps (minus elements of 3rd Armor Division) complete movement to forward assembly areas.

Feb 6 --VII Corps closes in theater with the arrival of last elements of 3rd Armored Division.

Feb 16 --Army attack helicopters conduct night raids on Iraqi positions.

1991

Feb 17	--Apache company from the 24th Aviation Brigade conducts attack on Iraqi electronic warfare (EW) site.
	--11th Aviation Brigade Apache crews capture 52 Iraqi prisoners of war (PW), from behind enemy lines without the help of any ground forces.
	--Apache crew from 1st Infantry Division engage two friendly armored vehicles. Two U.S. soldiers killed.
Feb 18	--Apaches from the 82d Aviation Regiment conduct two deep-attack missions along the main supply route to As Salman, destroying armored vehicles, air defense assets, and artillery pieces.
	--Apaches from the 12th Aviation Brigade conduct combat operations near As Salman airfield.
Feb 19	--Apaches from the 24th Aviation Brigade begin nightly deep, zone, and route reconnaissance into Iraq.
Feb 20	--Army attack helicopters destroy Iraqi bunker complex; 476 Iraqi soldiers surrendered.

1991

Feb 23 --Apache's from the 24th Aviation Brigade conduct armed escort mission in support of long-range surveillance team insertions.

Feb 24 --Coalition forces begin the ground phase of campaign (G-day), 0400, Saudi time.

--XVIII Airborne Corps and VII Corps conduct left flanking movement into Iraq.

--2nd Armored Cavalry Regiment is 45 kilometers inside Iraq by 1700, Saudi time. Apaches destroy three tanks, three bunkers, and three light armored vehicles.

--More than 300 attack and utility helicopters of 101st Airborne Division (Air Assault) strike more than 50 miles into Iraq.

Feb 25 --1st Cavalry Division's 4th Combat Aviation Brigade conducts cross-FLOT operations. One Apache is shot down by an unknown source. The Apache's crew members are not injured.

Feb 26 --VII Corps Apaches conduct deep attacks against Republican Guard divisions near western Kuwait border at Umm Al Madafi. 11th Aviation Brigade's battle damage assessment reports the destruction of 28 tanks, 19 armored vehicles, and 35 vehicles. No friendly aircraft were lost or damaged.

1991	--Apaches from the 3d Armored Division conduct deep operations. Battle damage assessments list 145 T54/55 tanks, 12 T62/72 tanks, 23 bunkers and trucks, air defense gun systems, armored vehicles, and artillery pieces destroyed.
	--XVIII Airborne Corps forces reach Euphrates River valley, completing encirclement of Iraqi forces, and begin attacks to the east.
Feb 27	--Republican Guard divisions crushed in large battles with VII Corps and 24th Infantry Division.
	--11th Aviation Brigade's Apache units conduct second deep attack against Republican Guard divisions near the western Kuwait border at Umm Al Madafi. 11th Aviation Brigade's battle damage assessment reports the destruction of 13 tanks and 23 armored vehicles.
	--Apaches from the 12th Aviation Brigade attack and destroy 37 trucks, 12 armored vehicles, 2 Iraqi helicopters, and 5 air defense pieces.

1991

Feb 27	--18th Aviation Brigade's Apaches record battle damage assessments of two Iraqi helicopters, two artillery pieces, 20 trucks, and an ammunition dump.
Feb 28	--Iraq accepts U.S. terms for ceasefire.
	--President orders cessation of offensive operations.
Mar 2	--Battle of the Causeway. Apaches and AH-1 Cobras team up to destroy hostile retreating Iraq units at the Rumaila oil fields. Iraq losses exceed 140 armored vehicles and 350 trucks. No U.S. casualties reported.

ENDNOTES

1. The stop loss program involves the suspension of laws relating to military separations and retirements to help the military retain fully trained personnel.

2. The term "closes" means the arrival of an organization's personnel and equipment at a specific destination.

APPENDIX B

MAPS

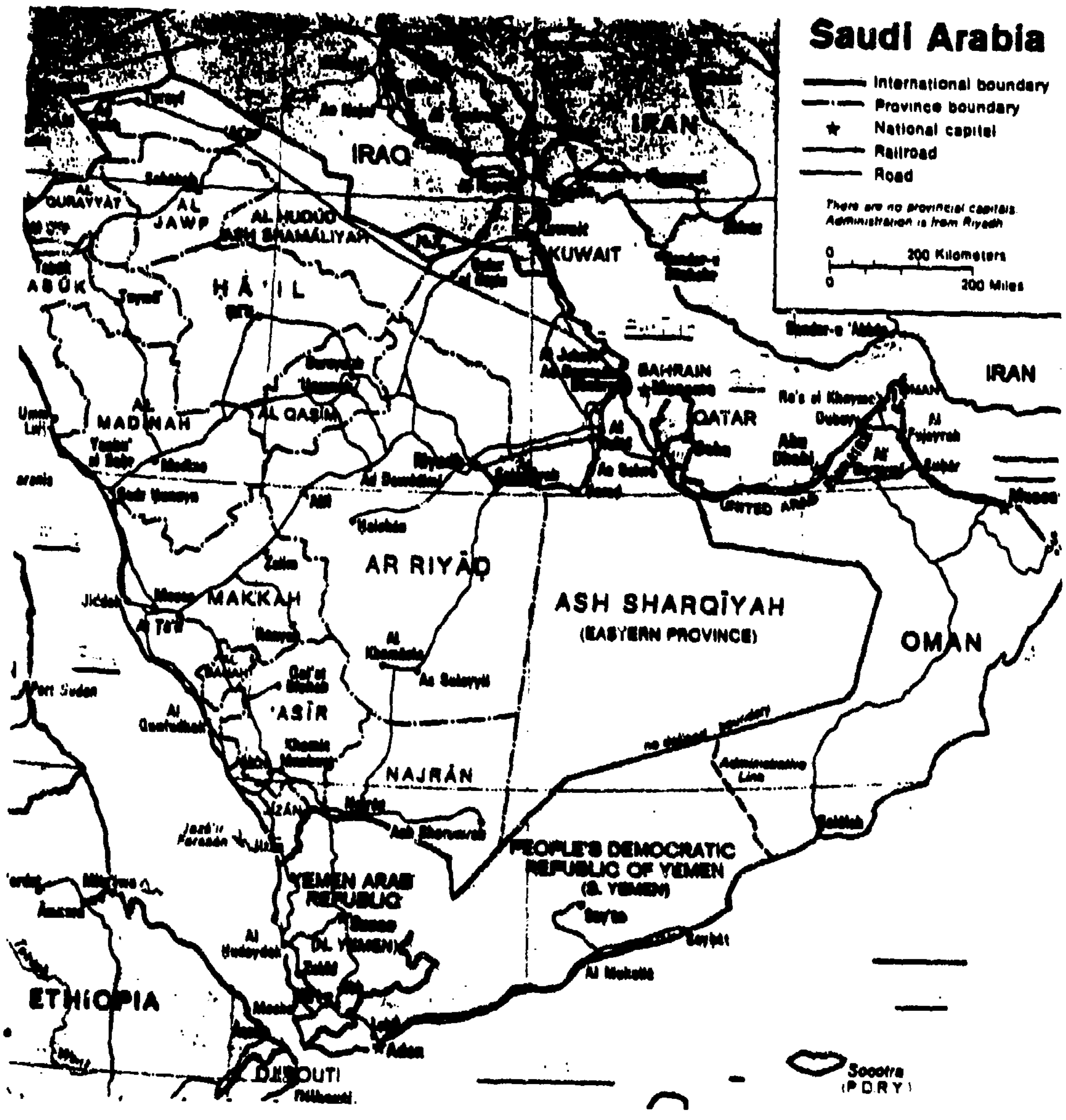

FIGURE 10. Map, Middle East
CIA, map base Southwest Asia (545543)

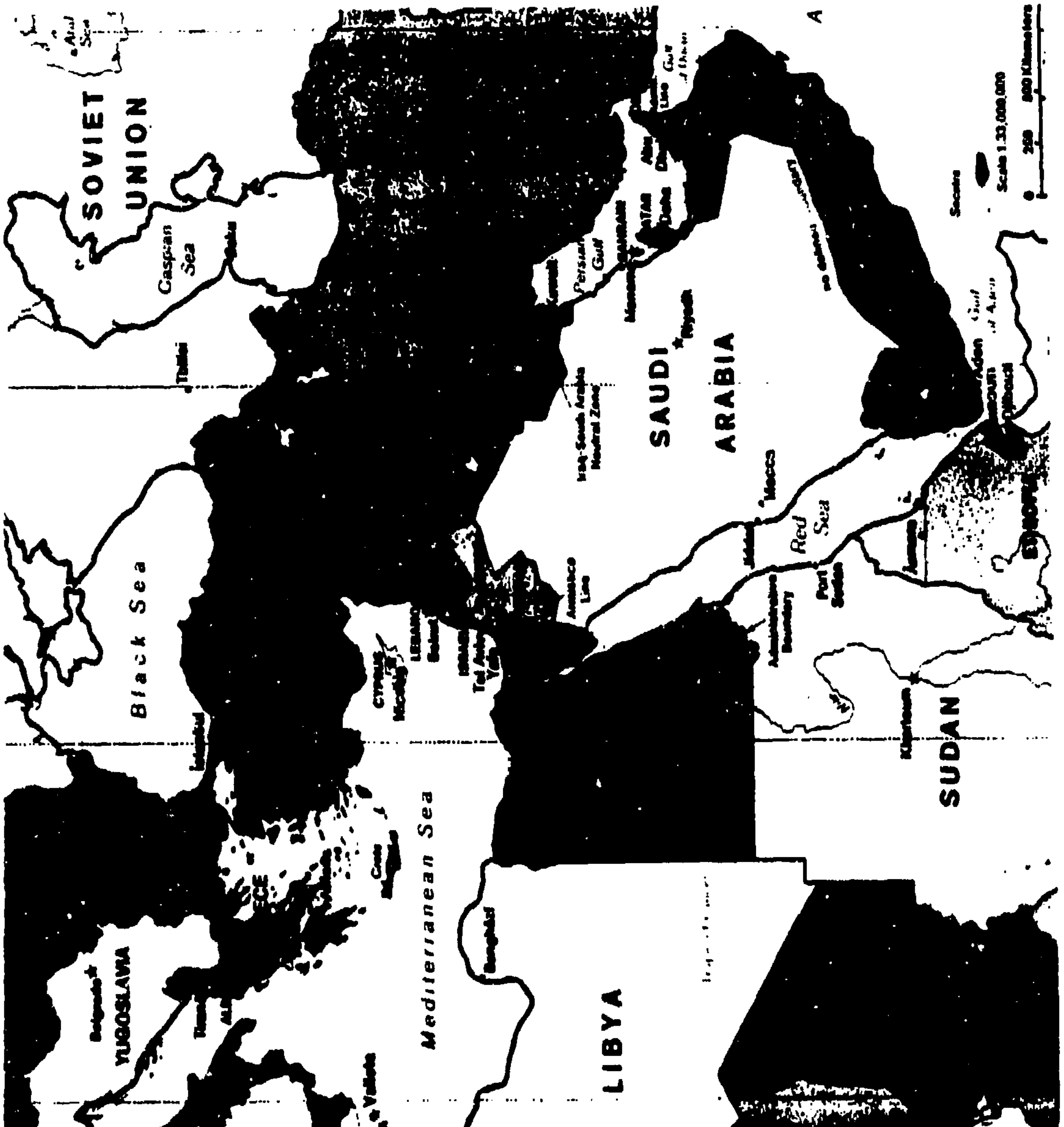

FIGURE 11. Map, Saudi Arabia
CIA, map base Saudi Arabia (544945)

GLOSSARY

A2C2	Army Airspace Command and Control
AASLT	air assault
AAR	after-action report
ACR	armored cavalry regiment
ARI	Army Research Institute
ASE	aircraft survivability equipment
ASET II	aircraft survivability equipment trainer
ATP	aircrew training program
AWACS	Airborne Warning and Control System
BDA	battle damage assessment
CGSC	Command and General Staff College
CMS	combat mission simulator
CONUS	continental United States
CSR	controlled supply rate
CSS	combat service support
CWEPT	cockpit weapons and emergency procedural trainer
D-Day	January 17, 1991
deg	degrees
DVO	direct-view optics
EAC	echelons above corps
EW	electronic warfare
FAA	forward assembly area
FARP	forward arming and refuel point
FLIR	forward-looking infrared
FLOT	forward line of own troops
FM	frequency modulated/field manual
FOV	field of view
FSS	fast sealift ship
G-Day	February 24, 1991

HF	high frequency
hr	hour
HVT	high-value target
IFF	identification friend or foe
IR	infrared
JAAT	joint air attack team
J-SEAD	joint suppression of enemy air defense
km	Kilometers
mhz	megahertz
mm	millimeter
MOS	military occupational specialty
NOE	nap of earth
OR	operational rates
PNVS	pilot night-vision system
PW	prisoner of war
R&D	research and development
rds	rounds
SEAD	suppression of enemy air defense
SLAR	side-looking airborne radar
SME	subject matter expert
SWA	Southwest Asia
TACSAT	tactical satellite
TADS	target acquisition designation system
UHF	ultra-high frequency
U.N.	United Nations
VHF	very high frequency

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