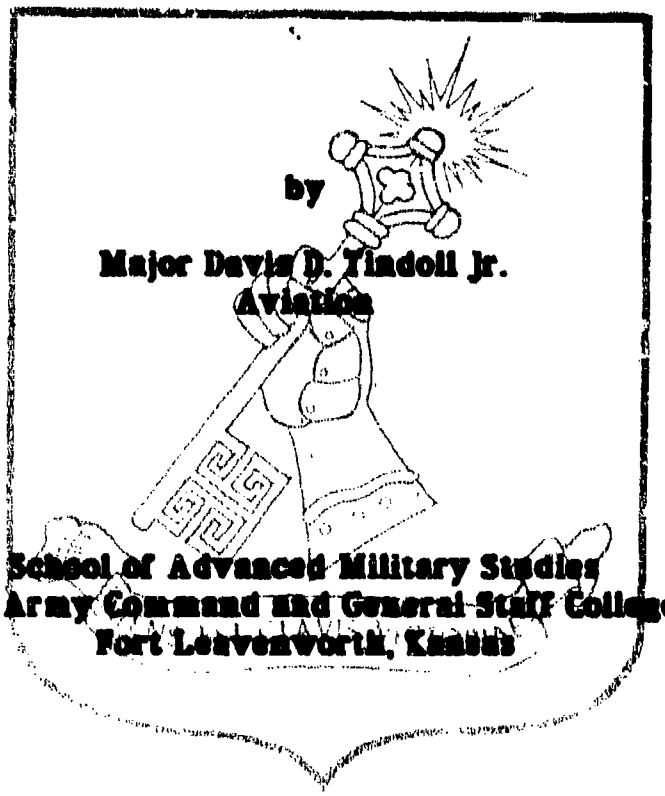
(2)

A Dedicated Army Aviation Unit for Counterair Operations, Is It Necessary?



by

Major David D. Tindoll Jr.
Aviation

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

5 December 1986

87-2117

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies, USAC&GSC 6b. OFFICE SYMBOL (If applicable) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Fort Leavenworth, Kansas 66027-6900	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
A Dedicated Army Aviation Unit for Counterair Operations; Is It Necessary? (U)

12. PERSONAL AUTHOR(S)
MAJ Davis D. Tindoll Jr., USA.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Monograph	FROM _____ TO _____	86/12/5	53

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	
			air-to-air, air defense systems, counterair, dedicated aviation unit, attack helicopters, Soviet helicopters

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This monograph examines the requirements for a dedicated aviation unit designed to destroy enemy attack helicopters. The ability of Soviet helicopters to impede and destroy friendly ground forces has created a new problem for Army leaders. Recognition of this problem has led to a search for counter measures. This monograph concentrates on the means of conducting counterair operations at the tactical level of warfighting.

First, the Soviet attack helicopter threat is discussed to demonstrate the importance of the attack helicopter to Soviet operations. The organizatio capabilities, survivability, and logistical constraints of Soviet helicopter forces are presented. The Soviet philosophy concerning offensive air-to-air combat is discussed.

(continued on back)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
MAJ Davis D. Tindoll Jr.	(913) 684-2138	ATZL-SWV

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

3117

continued from Block 19:

Next, the monograph examines the weapon systems designed to defeat the Soviet helicopter threat. The combination of ground based air defense systems and fighter aircraft are analyzed as to the degree of protection they provide to friendly forces. The major problems inherent to these air defense weapons are discussed. A determination on the feasibility of these air defense systems is based on recent tests and historical combat experienc

The capabilities of Army aviation units conducting aerial combat are examined. The tactical doctrine, flight tactics, and training for air-to-ai combat are presented as the main ingredients for success. The importance of aircraft technology in regard to airframes and armament is analyzed to determine the standard for a dual role attack helicopter.

Finally, the criteria for a dedicated aviation unit for the purpose of aerial combat are established. The trade-offs required in the developmen of either a multipurpose or special purpose attack helicopter are discussed. Two examples of a dedicated aerial combat aviation unit are presented and its cost in terms of mission success are analyzed.

A Dedicated Army Aviation Unit for Counterair Operations, Is It Necessary?

by

Major Davis D. Tindoll jr.
Aviation

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

5 December 1986

87-2117

School of Advanced Military Studies

Monograph Approval

Name of Student: Major Davis D. Tindoll Jr.

Title of Monograph: A Dedicated Army Aviation Unit for Counterair Operations. Is It Necessary?

Approved by:

(LTC (P) Richard M. Swain, Ph.D.) Seminar Leader

(COL Richard Hart Sinnreich, MA) Director, School of Advanced Military Studies

(Philip J. Brookes, Ph. D.) Director, Graduate Degree Programs

Accepted this 20th day of December 1986.

ABSTRACT

A DEDICATED AVIATION UNIT FOR COUNTERAIR OPERATIONS; IS IT NECESSARY? by Major Davis D. Tindoll Jr., USA, 53 pages.

This monograph examines the requirements for a dedicated aviation unit designed to destroy enemy attack helicopters. The ability of Soviet helicopters to impede and destroy friendly ground forces has created a new problem for Army leaders. Recognition of this problem has led to a search for countermeasures. This monograph concentrates on the means of conducting counterair operations at the tactical level of warfighting.

First, the Soviet attack helicopter threat is discussed to demonstrate the importance of the attack helicopter to Soviet operations. The organization, capabilities, survivability, and logistical constraints of Soviet helicopter forces are presented. The Soviet philosophy concerning offensive air-to-air combat is discussed.

Next, the monograph examines the weapon systems designed to defeat the Soviet helicopter threat. The combination of ground based air defense systems and fighter aircraft are analyzed as to the degree of protection they provide to friendly forces. The major problems inherent to these air defense weapons are discussed. A determination on the feasibility of these air defense systems is based on recent tests and historical combat experience.

The capabilities of Army aviation units conducting aerial combat are examined. The tactical doctrine, flight tactics, and training for air-to-air combat are presented as the main ingredients for success. The importance of aircraft technology in regard to airframes and armament is analyzed to determine the standard for a dual role attack helicopter.

Finally, the criteria for a dedicated aviation unit for the purpose of aerial combat are established. The trade-offs required in the development of either a multipurpose or special purpose attack helicopter are discussed. Two examples of a dedicated aerial combat aviation unit are presented and its cost in terms of mission success are analyzed.

TABLE OF CONTENTS

I. INTRODUCTION

The purpose of this monograph is to determine if there is a requirement for a dedicated aviation unit designed to destroy enemy attack helicopters. Just as tanks have always been the most effective weapon against tanks, helicopters may become the most effective means of fighting helicopters. In any case, the use of helicopters by both sides will inevitability lead to clashes between them.[1] Encounters with Soviet helicopters are inevitable in the conduct of close, deep, and rear operations. This new and lethal dimension of combined arms combat is the most flexible response to a growing Soviet helicopter threat.

Two major functional areas of airland battle, air defense and tactical air operations, require friendly counterair operations for success. These functional areas involve the integration of Air Force and Army assets to gain control of the air environment, to preclude the attack of ground forces and friendly aircraft, and to insure the destruction of hostile aircraft.[2] The ability of Soviet helicopter forces to impede and destroy friendly ground forces has created a new problem for Army leaders. Recognition of this problem has led to a search for countermeasures. Recently, Army leaders discussed whether Army aviation units should be given the mission of planning for and conducting deliberate air-to-air operations.[3] The role of the helicopter is expanding to the extent that Army aviation is now addressing the requirements and abilities of helicopters in the counterair role.

Heretofore, the primary role of the attack helicopter unit has been that of a maneuver unit within the combined arms team. Is it also necessary to commit such units in an attempt to gain air superiority in the nap of the earth environment? This has been a sore point within the Army for a

considerable period of time. Opponents of this proposal object to Army aviation becoming another Air Force. Killing tanks, it maintains, is the most effective mission for the attack helicopter. However, the threat to one's own forces posed by an enemy attack helicopter can not be discarded so easily. It too must be addressed and the helicopter counterair concept may be the most efficient and effective way possible.

Counterair operations are those operations conducted to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy aviation forces.[1] The objective of counterair operations is to gain control of the air environment and protect the force. The importance of conducting counterair operations is the degree of freedom granted by friendly domination of the air over the battlefield. This allows for the uninterrupted employment of Army aviation and Air Force assets to achieve the commander's aim. When there is an offensive air threat to friendly surface operations, the requirement for friendly counterair action must be a major consideration for joint planning. There are three types of counterair operations. They are defensive counterair, offensive counterair, and passive counterair. Aerial combat or air-to-air combat is a subset of counterair operations. Air-to-air combat can be conducted in both defensive and offensive counterair operations.

Defensive counterair is the protection of friendly forces from enemy aircraft. All members of the combined arms team will employ assets in the defensive counterair plan. Field artillery units can react to the enemy helicopter threat by denying avenues of approach and stand-off firing positions. The maneuver forces conduct defensive counterair with their vehicles' main guns by destroying attacking aircraft. The air defense artillery will attack incoming aircraft. The Air Force can provide a combat

air patrol to deny the enemy use of the airspace. Army aviation has the greatest potential to react to the helicopter threat because of its mobility and rapid response capability.

Offensive counterair is a high risk/high payoff operation. It is conducted to destroy the enemy's air power at the time and place which best support the commander's intent.[5] The most efficient technique is to destroy the enemy's assets where he is most vulnerable, on the ground. Targets for offensive counterair operations would be aircraft (fixed wing and helicopter), air defense systems, logistical support for these weapon systems, and the command & control facilities for aviation and air defense units.

Passive counterair is a function of defensive counterair operations. It includes all of the measures taken by friendly units to reduce enemy effectiveness. Some of these measures are concealment, dispersion, deception, and hardening of positions.

This monograph will focus on the means of conducting counterair operations at the tactical level of warfighting. Recognition of the importance of the attack helicopter to Soviet operations is vital for an understanding of a need for friendly counterair operations. Close air support operations are crucial to Soviet tactical and operational success. A section of the monograph will discuss why the Soviet attack helicopter is rapidly becoming the principal weapon system in this role. The roles and capabilities of the Soviet attack helicopter will be addressed. The trend from the multipurpose to the specialized helicopter will be analyzed to demonstrate the Soviet attitude toward helicopter aerial combat. Soviet doctrinal emphasis and the rapid growth rate of Soviet helicopter forces should be major causes of concern for their adversaries. They should stimulate interest in finding methods to defeat this growing threat.

The paper will examine the weapon systems designed to defeat the helicopter. Historically, the U. S. has relied on a combination of ground based air defense systems and fighter aircraft to protect forces from air attack. The adequacy of this combination of forces to counter the existing Soviet helicopter threat will be assessed.

Soviet military thinkers believe the helicopter is the best antihelicopter weapon system on today's battlefield. A noted Soviet doctrinal writer, Colonel M. Belov has observed: " it has become vital to get a weapon which could compete with the helicopter..... logic and historical experience suggest that such a weapon is the helicopter itself."[6] The paper will also address aerial combat for helicopters. It will stress the need for an air-to-air combat doctrine. It will highlight the importance of tactics, training, and equipment if Army aviation units plan to be successful in this arena.

All these issues must be addressed to determine whether an Army aviation unit should be dedicated to the counterair role. Analysis of the threat capability, the means available to neutralize this capability, and the major constraints on the ability of aviation units to perform this mission will lead to a conclusion. Should Army aviation units be dedicated to the counterair mission?

II. THE SOVIET HELICOPTER THREAT

The Soviets view the attack helicopter as the most effective weapon system for use against armor.[7] Therefore, it is important for Army leaders to understand the significance of the Soviet helicopter on today's battlefield. The Soviets have developed a great deal of interest in the employment and

capabilities of helicopter units. Reasons for this interest in helicopters are the influence of the US Army experience in Vietnam, the development of the antitank helicopter within NATO forces, and the Soviets' own experience in Afghanistan.[8] It is believed that the helicopter will soon become their principal ground attack weapon system. The Soviets believe that in engagements where attack helicopters are employed against armored units, the helicopter will provide a correlation of forces of 12-19 to 1 in favor of the helicopter.[9] The attack helicopter has the capability to disrupt totally a commander's scheme of maneuver.

This section will assess the Soviet helicopter threat. It will discuss the Soviet concept of air support of ground forces. It will examine the capabilities and trends in Soviet rotary wing aviation, the survivability of Soviet helicopter forces, and the logistical constraints on the employment of these forces. Finally, the section will examine the Soviet philosophy on the role of the helicopter in offensive air-to-air operations.

The Soviets utilize their fixed wing aircraft and combat helicopters' in three stages or levels of air support for offensive ground operations. These are the support of the immediate battle area, interdiction, and penetration operations.[10] The increasing numbers of helicopters deployed in Soviet divisions and armies enable them to play a greater role in the total air support effort. The particular role of the growing attack helicopter capability is the support of ground forces within the immediate battle area. Assumption of these missions by rotary wing aircraft enables the front commander to utilize his fixed wing aircraft for interdiction and penetration missions against fixed targets. These fixed targets are nuclear weapon delivery means, nuclear storage sites and airfields.

The Soviet helicopter threat is growing rapidly. The comparison of attack helicopters between NATO and Warsaw Pact forces shows a Warsaw Pact advantage of 2 to 1. In transport and support helicopters NATO has a 1.6 to 1 advantage over the Warsaw Pact.[11] The Soviets philosophy of not throwing anything away applies to helicopters as well. Helicopters built in the 50's are still in the Warsaw Pact inventory. In 1980 HINDs alone rose to 1450 fielded with a production rate of 15 per month. The predicted Soviet helicopter production between 1980 and 1990 is approximately 6,000 to 8,000 aircraft.[12] This will result in a formidable helicopter fleet. Before the turn of the century the Warsaw Pact forces will have a larger advantage in attack helicopters, as compared to NATO forces, than they currently have in tanks.

The Soviets are relying on the attack helicopter to replace their fixed wing aircraft in the close air support role.[13] The HIND has assumed the role played by the ground attack fighter. In fact, the Soviets have nicknamed the HIND the Shtrumovik. The Shtrumovik was a close air support aircraft, the IL-2, in World War II. There are very close similarities between the two aircraft in performance capabilities, armament, and armor.[14] The Soviets have integrated the lessons learned from the Shtrumovik in the employment of the HIND. The anticipated missions of the HIND and follow-on attack helicopter will be escort of airmobile forces, fire support, antitank, and close air support.

Soviet attack helicopters are organized at army and division levels. This tactical decentralization of control of what in the Soviet Armed Forces is an Air Force asset allows for rapid response and positive control. The division helicopter squadron currently has 18 aircraft. All of these aircraft have an antitank capability. There are 6 HOPLITE helicopters designed for

command and control duties. There are 6 HIP helicopters which are multipurpose aircraft with the primary purpose of handling limited troop carrying and resupply activities in the Division. The Squadron has 6 HIND helicopters, another multipurpose aircraft, which provide the antiarmor capability. At the Army level there is one attack helicopter regiment. This regiment contains 40 HINDs that provide the commander a formidable antitank and fire support asset. The regiment also has one HIP squadron with 20 helicopters that provides the air assault transportation capability for the Army. Over half of the regiments now formed in the Soviet Army are deployed opposite NATO.[15]

Traditionally, the Soviets have built their helicopters to be multipurpose weapon systems. The reasoning behind this is that the multipurpose helicopter gives the commander the versatility to perform various missions with each helicopter. Each of the helicopter types has the capability to employ some type of weapon system. All of the helicopters found at division and army level have the capability to be employed as antitank weapons. All can be employed as fire support assets with their 57mm rockets or bombs. All helicopters armed with a 12.7 weapon system have a defensive air-to-air capability. Attack helicopters have a significant air-to-air capability with the AT-6 Spiral missile and multibarreled 23mm cannon. A good example of this propensity to multiple capabilities is the HIND.

The MI-24 HIND is the present workhorse in the Soviet arsenal. It is the ideal multipurpose helicopter. It can be employed in an air assault role carrying 12 combat equipped soldiers, an antitank role with AT-6 spiral missiles, a fire support role with rockets, missiles, and bombs, and in the air-to-air role with its cannon and missiles. The HIND can carry an ordnance load of 4 antitank guided missiles, four 32 shot 57mm rocket pods, and a

23mm cannon or 12.7mm multibarrelled machine gun that is turret mounted. The antitank guided missiles and rocket pods can be replaced with 750 kilograms of chemical or conventional bombs on each wing.[16] The HIND fire control system includes a heads-up-display and a low light television. It has a radar and is fully equipped for instrumented flight. The night capability is achieved through a passive night vision system or possibly a first generation thermal imaging system.[17] It is built for survival on the battlefield. It has extensive armor plating surrounding the crew members, a bullet proof glass cockpit, and armor protection for vital components. Afghanistan has proven that the HIND is virtually invulnerable to attacks from below with projectiles of up to 12.7mm.[18]

Soviet thought has changed somewhat with the addition of the HAVOC and the HOKUM to their attack helicopter arsenal. These aircraft appear to be created for specific roles with the capability of conducting other missions when necessary. The HAVOC has been built with the primary purpose of killing tanks. It is very similar to the AH-64 Apache. It can accomplish the same missions and has a similar air-to-air capability. It is smaller than the HIND, a major change for the Soviets who have always built helicopters much larger than their American counterparts. The armament on board includes an under the nose gun turret with weapons mounted on the wings. Survivability and performance are increased with two turbine engines. There is a strong possibility of a low light television for operations in limited visibility conditions. The HAVOC has a stand-off weapon delivery capability like the Apache. The ranging for the stand-off weapon systems is conducted with a laser designator giving it a capability to use fire and forget missiles. The HAVOC can be expected to be operational in division and army regiments within two years.[19]

The newest aircraft on the Soviet scene is the HOKUM. This aircraft will provide the Soviets a significant rotary wing air superiority system.[20] It is lighter than the HIND, with a take off weight of 11,990 pounds. It has co-axial counter-rotating main rotors which will provide excellent maneuverability. The HOKUM will contain two crew members in order to increase its performance. Two crew members allows for quicker acquisition of targets, less crew fatigue to allow the weapon system to be employed for longer periods, and increased survivability in an air-to-air engagement by division of crew duties. HOKUM is designed as a high performance helicopter with excellent agility. The on board armament makes it a genuine air-to-air combat aircraft as well as providing a ground attack potential. The retractable landing gear is an indicator of the high speed (over 200 miles per hour) it will attain. Like all other Soviet attack helicopters it is heavily armored, particularly in the cockpit area. The Soviets believe that these helicopters, operating in the antitank role in a nap of the earth flight mode, can achieve a kill ratio of 30 to 1.[21]

As a result of lessons learned in the combat environment of Afghanistan, the Soviets have outstanding survivability equipment for their attack helicopters.[22] The aircraft have infrared suppression measures to defeat most anti-aircraft missiles, and armor protection for vital components and the crew that will withstand 20 mm rounds. They are developing an on board jamming capability that will defeat air defense radars. These capabilities enhance the overall effectiveness of the helicopter on a mid-intensity battlefield.

An important vulnerability of Soviet helicopter units is their logistical tail. Understanding how the Soviets handle their fuel and ammunition for helicopters will benefit the friendly maneuver commander who must assess

the importance of this target. Soviet helicopter units will operate from airfields or improved field sites outside the range of enemy artillery. When operating forward, near the forward edge of the battle area, helicopter units will resupply at forward area rearm and refuel points similar to the forward arming and refueling points, (FARPs) used by U.S. Army aviation units. When possible, these rearm and refuel points will be remote airfields.[23] The major difference between U.S. Army FARP's and Soviet rearm and refuel points is flexibility. The Soviets are inflexible because they demand centralized logistical control of their aviation units. The Soviet rearm and refuel points are not as mobile as U.S. Army aviation FARP's. Displacment of their rearm and refuel points will occur when required by the tactical situation. This promises a very vulnerable target when the Soviets are resupplying with fuel and ammunition. The process will normally occur at a relatively fixed base on a large scale. Because such sites are well protected, a quick, well-organized attack by offensive counterair assets would be a high-risk operation but one with the potential for a very high payoff.

Soviet principles of air-to-air combat demonstrate their philosophy of offensive air-to-air operations. These principles are aggressiveness, surprise, fire and maneuver, and the perfection of tactics.[24] To be aggressive is to seize the initiative. Initiation gives the pilot the means to create the necessary tactical situation instead of being subordinate to it. Surprise means to maneuver so one's aircraft is concealed. This is essential in order to ensure one's intentions remain secret until the moment of attack. To combine maneuver and fire is to take advantage of the enemy's weak points. Perfection of tactics is to know the enemy and know yourself. These principles are imbedded in attack helicopter crew training. Soviet crews are

aggressive, have good weapons platforms, and will commit themselves to aerial combat to destroy enemy attack helicopters.

The Soviet attack helicopter has proved to be a highly effective weapon system. It can disrupt friendly maneuver. It is highly superior to other combat vehicles in regard to observation, maneuverability, and quickness in delivering a blow. This threat must be addressed as it grows not only in importance in the Soviet combined arms arsenal but in its strength of rapidly growing numbers. The Soviets have designed their advanced helicopters to eliminate what they believe to be the greatest antitank weapon on the battlefield, an attack helicopter. By introducing the HOKUM they have taken the initiative in the aerial combat arena. The next section of this paper will address how to defeat this threat.

III. THE MEANS TO DEFEAT THE THREAT

Air Force and Army air defense units have the mission to deny the Soviets use of the airspace over the battlefield. The Army and Air Force conduct air defense jointly. Ground-based air defense systems currently lack sufficient line of sight and density to counter all enemy aircraft threatening the combined arms team. Likewise, the Air Force lacks sufficient resources to cover the entire battle area. There are several problem areas in regard to countering the attack helicopter with existing air defense assets. The following paragraphs will discuss the Army's air defense artillery and Air Force capability in defeating this specific aerial threat.

AIR DEFENSE ARTILLERY

The emphasis in providing air defense for front line maneuver forces has shifted over the last 20 years from countering fighter bombers to defeating standoff helicopters, although the need to counter fixed-wing aircraft still exists.[25] In the aftermath of the demise of the DIVAD air defense weapon system, the Army has hastened to improve its battlefield air defenses. The Army would like to field as soon as possible a system to perform the mission for which the DIVAD was intended, that of successfully destroying hovering enemy helicopters at their operating ranges. Current weapon systems that provide maneuver units protection will be discussed in the following paragraph. The major problems inherent in a ground air defense system will be covered next. The new air defense concept of forward area air defense (FAAD) will be analyzed to determine if it might resolve the issue. Lastly, a discussion of a combined arms solution to react to the attack helicopter threat is presented.

Current air defense artillery weapon systems designed to protect maneuver forces within the division do not accomplish the mission. Current air defense artillery weapons have numerous deficiencies that must be resolved to achieve an effective protection of maneuver forces. These systems provide a safe operational envelope for the enemy helicopter operating at ranges between 3 to 6 kilometers.[26] The Hawk and Patriot missile systems are designed to destroy aircraft beyond a range of 10 kilometers. They must rely on radar to detect the threat aircraft. These systems are located 10 kilometers or further from the front in order to protect their radar and missile launchers from the effects of enemy artillery. In this position, these systems are unable to detect aircraft flying at low

altitudes using the terrain, trees, and buildings to shield them from air defense radar. Short range air defense assumes the responsibility of air defense closer to the front lines. These systems are smaller and have greater mobility so they may deploy with maneuver units close to the forward edge of the battle area. The Army currently has three short-range systems. They are the Chaparral, Vulcan, and Stinger.[27] The Chaparral is a line of sight system with infrared missiles as the primary weapon. These missiles have a range of 5 kilometers. Drawbacks to the system are the fact that it must be in a stationary position to fire and it must have a clear visual line of sight. For these reasons the Chaparral is best employed in the protection of stationary targets. The Vulcan offers little capability against enemy aircraft, especially helicopters that can stand off at long ranges while attacking. Vulcan range is only 1200 meters. The Stinger is a small portable air defense weapon that fires an infrared missile with a 6 kilometer range. However, the range is reduced to 3 or 4 kilometers against a helicopter hovering in the nap of the earth flight mode. One drawback of the Stinger is its vulnerability to indirect and direct fire. Another drawback is the limited range resulting from the positioning of the weapon system in an overwatch mode to increase its survivability.

There are numerous problems associated with a credible ground air defense system. These problems are line of sight to the target, limited numbers of weapon systems, insufficient range of weapon systems and mobility. Helicopter tactical employment method is the cause for the limited line of sight. Most air defense weapon systems that engage helicopters must have a direct line of sight with the target in order to engage it. It is extremely difficult to detect a helicopter in a stand off battle position at 6 kilometers hovering at an altitude of 60 feet. In a European scenario, only

20 percent of the deployed air defense weapon systems would be able to see a helicopter at this distance.[28] The line of sight of other air defense systems would be obstructed by terrain features.

The range and numbers of weapon systems are the two major problems in fielding a credible ground based air defense against attack helicopter. If an enemy helicopter were able to engage a friendly unit from 6 kilometers, as many as 11 weapon systems could be needed to achieve a 50 percent probability that at least two air defenders could see the target.[29] Because of limited numbers, it is not, possible to cover all of the division's units with this kind of mass coverage. Against a helicopter with a 6 kilometer stand off range, 7 air defense systems with an effective range of 8 kilometers are needed for every 5 kilometers of front. Currently, there are no systems with this capability. The potential engagement ranges of present systems go from 14 at 3 kilometers to 0 at 3.5 kilometers.[30] An attack helicopter can fire highly destructive missiles from a distance beyond the capability of current air defense weapon systems.

Individual air defense weapons usually locate up to a kilometer behind the most forward troops to ensure their own survivability. If enemy helicopters attack maneuver assets from ranges of five to six kilometers, air defense systems must have a maximum range of at least seven to eight kilometers. Today's air defense systems do not have sufficient range nor are they deployed in sufficient numbers to provide a credible air defense.

The final problem is the lack of mobility for air defense forces. Present forces have difficulty being in the right place at the right time. Ground air defense units attempt to provide adequate air defense on an area basis. It is difficult to respond to fleeting concentrations of enemy aviation forces. As it is, there are not enough air defense assets to cover all avenues of approach

and all friendly unit. When helicopters mass on the battlefield, unlike armored targets, they may cover an area of several kilometers. With such tactics, air defense artillery requires multiple weapon systems to provide adequate coverage. These are a few of the major problems that hamper ground air defense units in their ability to cover the battlefield.

The Army is developing a forward area air defense system capable of attacking targets in masked positions. This system is based on a five-part plan.[31] The first part is the improvement of the command and control of the various air defense assets within the division. This plan will employ new early warning sensors that would be airborne and ground based. This is meant to improve the sharing of critical information in order to alert all units of an attack as soon as possible. The second part is the development and fielding of a new non-line of sight missile. This non-line of sight missile will have a television or radar mounted in the nose that will aid in locating the target and destroy it. The missile will be a high technology fiber optically guided missile (FOG-M). The third part of the plan calls for the fielding of a new system for the rear portion of the forward area, 5 to 15 kilometers from the front line. This rear area system will probably be a Stinger missile mounted on a truck as the launcher platform. This system will replace the Chaparral. The fourth component of the plan calls for a new air defense system for protection of the maneuver elements. This system is the replacement for the DIVAD. The system will probably be a mixture of guns and missiles with an 8 kilometer range. The final part of the plan is to upgrade the air defense capability of the fighting vehicles within the division. This is directed at the tanks, Bradley fighting vehicles, and scout helicopters within the division. Development of an anti-aircraft round for the tank and the modification of the Bradley fire control system to attack

aerial targets is the primary focus of this upgrade. Problems that must be considered with the overall plan are the availability of technology and money. Overall, the plan is impressive but it has two major drawbacks. First, it is not expected to be fielded for at least ten years. In that time, the possibility of technology producing better electronic warfare gear could change the outlook. The possibility of jamming the early warning sensors or the fiber optical missile would destroy the air defense capability of the maneuver force. Secondly, cost may be the driving factor on how well the plan is supported.

An option that must be considered in finding a way to defeat the helicopter is the integration of the combined arms in air defense. There are adequate numbers of fighting systems if all become air defense capable. This option would be inexpensive and possess good resistance to countermeasures. It would also provide a badly needed night fighting capability. A study by the Congressional Budget Office's National Security Division conducted for the House Committee on Armed Services stated that such a combined arms air defense plan would achieve the following results:[32] It would create as many as 16 potential engagements against hovering helicopter at 3.5 kilometers and 9 engagements at 6 kilometers. This assumes that all tanks and fighting vehicles would devote their efforts to air defense. In that case, under a helicopter attack the crews would orient on the most dangerous threat. The division's tanks and fighting vehicles would need to be modified to enhance their effectiveness without significantly degrading their ability to perform their primary missions. Tanks would be equipped with a missile or round to engage aircraft. The development of a round that would be effective against both air and ground targets would be required. The Bradley 25mm gun is effective against slow

moving helicopters but its range is only 2 kilometers. The TOW missile mounted on the Bradley must be upgraded. The TOW's speed should be increased to Mach 2 and its range to 7 kilometers. The Stinger missile should be upgraded with a longer range and night capability. Helicopters would mount air-to-air missiles to increase the combined arms air defense capability. More early warning radars would be needed to cue the fighting vehicles on the threat. The Stinger teams would be increased and Chaparral units would be retained to provide air defense for the rear areas.

CAPABILITIES OF THE AIR FORCE

The Air Force has the responsibility to conduct counterair operations, which include the destruction of helicopters, in order to achieve air superiority.[33] The following paragraphs discuss several issues that demonstrate the difficulty involved in the successful accomplishment of this mission. Specifically, this section will address the problems presented to fixed wing, high-performance aircraft by the flight characteristics of the helicopter. Evidence presented will be drawn from service interactive flight tests and actual experience in the Falklands. The section will seek to determine the feasibility of aerial combat between high-performance aircraft and the attack helicopter.

The Air Force has a significant problem conducting counterair operations against threat helicopters. The primary problem for fighters engaging helicopters in the aerial combat role is the unique flight characteristics of the helicopter. The maneuverability and operating envelope of the helicopter create several challenges. The ability to hover, combined with rapid-speed

changes, are a problem to a fast-moving aircraft. The maneuverability of the helicopter is a significant problem. The turning ability of the helicopter forces the fixed-wing aircraft to make numerous passes in order to achieve a kill. The helicopter's ability to fly lower and slower creates problems for the high-performance aircraft. This forces the fixed-wing pilot to commit to an engagement or maneuver before the helicopter does, giving the helicopter the advantage. These characteristics are multiplied in poor weather giving the helicopter a distinct advantage, especially if the combat arena is in an area such as Europe with predominantly low ceilings and visibility. The helicopter makes a difficult target for the primary air-to-air weapon system of the fighter, the antiaircraft missile. The downwash of the rotor system created at a hover or in slow flight, combined with ground clutter present in the nap of the earth, makes the helicopter a bad infrared target.[34]

The Soviets view similar difficulties in the aerial engagement of the helicopter by fighter aircraft. The tests and studies they have conducted show fixed-wing aircraft operations against helicopters to be ineffective. These tests have provided four reasons for this ineffectiveness.[35] They are the complexity of locating the helicopter in its flight realm, the difficulty of attacking a slow-moving target, the ability of the helicopter to fly very close to the ground, and the impossibility of aerial combat in bad weather. These problems must be countered to preclude the success of enemy helicopters. The Soviets believe special training is needed for their fixed-wing pilots properly and successfully to engage slower-moving targets. The most difficult problem to overcome is the acquisition of the helicopter because of its speed and maneuverability. Therefore, the most complicated task in the conduct of pilot training is the development of necessary search skills. When a pilot begins to see a helicopter, he cannot determine the direction of

movement until the target is at 2 to 2.5 kilometers. If the pilot does not concentrate on the helicopter movement throughout his engagement, he will lose the target and may even become prey to the helicopter. With these problems in mind, the Soviets plan and train to engage helicopters attempting to interfere with their maneuver units.

All of the U.S. military services have conducted tests to determine the strengths and weaknesses of the helicopter in aerial combat with a high-performance aircraft. The United States Air Force and Army have conducted joint testing which has determined the strengths and weaknesses of the helicopter in aerial combat. The Joint Countering of Attack Helicopters test, J-CATCH, began in May 1978. The purpose of this program was to explore and develop joint tactics for United States forces in countering the Soviet attack helicopter threat.[36] The Army and Navy have conducted similar joint tests at the Navy Fighter Weapons School. They have determined the aerial combat capabilities and problems of the match-up between a AH-1 (Cobra) and a Navy F-5Es. The Air Combat Engagement (ACE) test was conducted by the Air Force and Army. This test demonstrated the present techniques of helicopter flight. It was determined that these techniques degrade the ability of high-performance aircraft to attack helicopters.[37]

The J-CATCH testing provided the most interesting insights concerning the capability of fighter aircraft to engage the attack helicopter. The Air Force air crews found the helicopter to be extremely difficult to hit. They found out that the helicopter was virtually impossible to track. The best technique to achieve a kill was a slashing attack, a quick surprise attack. They discovered the helicopter was not a slow, vulnerable target. It could be a dangerous foe. The air crews' after-action reports found the helicopter to be as dangerous as a ground gun emplacement.[38]

The J-CATCH scenarios utilized F-15s, F-4s, and A-10s against Soviet type helicopters in force on force engagements. The F-15s were able to acquire a helicopter at extended ranges, in excess of 64 km, with their look down pulse doppler radar. Visual acquisition occurred at 6-9 kilometers. The high performance aircraft would ingress at low level in order to silhouette the helicopters on the horizon. The exchange ratios between the high-performance aircraft and helicopters vividly demonstrate the problems in this realm of aerial combat. The table below depicts the average kill ratio of high performance aircraft (first number in ratio) against the helicopter (second number), with specific air-to-air armament. [39]

Armament	Ratio
AIM-7F/AIM-9L (F-15)	(2.9 to 1)
20MM Cannon (F-4)	(.7 to 1)
30MM Cannon (A-10)	(1.3 to 1)

The J-CATCH findings did not recommend the AIM-7E and F air-to-air missiles against low altitude targets. The problem has to do with establishing a lock-on because of ground clutter and the infrared source.

The aircraft attempted to use the weapon system with the best stand off range against the helicopters. The most effective range was approximately 1400 meters for the 20mm cannon and 1550 meters for the A-10's 30mm cannon. The maximum range for the 23mm cannon on the HIND was 2000 meters. This range gives the helicopter the advantage because of its maneuverability. This maneuverability allows the helicopter to maintain a much longer burst on the faster moving aircraft. The aircrews concluded that fighter attacks should not be pressed to within the helicopter's cannon range.

The AIM 9L air-to-air missile fired at 2500 meters from the threat was the best weapon system to employ. The best tactic for the helicopter crews was to terrain mask making acquisition difficult for the fixed wing pilots. The helicopters would work as a team of two or more aircraft to provide mutual support between each other and attempt to make an unobserved shot. It is important to note that the opposing helicopters were not carrying air-to-air missiles such as the SA-7 or SA-9 in the conduct of the test. These missiles would have a range of 3600 meters and 7000 meters respectively. This additional weapon system would allow the helicopters a tremendous advantage. If the helicopters crews acquired the fixed wing aircraft first, they could destroy the high performance aircraft well beyond the recommended engagement ranges of the fixed wing weapon systems. The possibility of the AT-6 Spiral antitank missile being fired at the fixed wing aircraft was not tested. The range of this missile is 5,000 meters and it will travel the distance in 11 seconds.[40] An antitank weapon system with very high speed, such as the AT-6, provides an additional advantage to the helicopter.

In phase IV of the J-CATCH test the tactical fixed wing aircraft worked jointly with Army attack helicopter teams. This effort was similar to a joint air-to-air attack team operation or what might be depicted in a deep attack scenario for an attack helicopter battalion. This phase demonstrated that simultaneous operations by attack helicopters and tactical aircraft increased force effectiveness against enemy helicopters.[41] The synergistic effect of both weapon platforms enabled each component to maximize the strengths of the other. Such an operation cannot be haphazardly executed on the battlefield. A great deal of prior coordination and planning is involved in this type of endeavor.

There are historical examples where fixed wing aircraft have been successful in establishing air superiority against helicopter forces. The Falklands campaign provides a good example of this success. The British used the AV-8 Harrier to establish air patrols. These patrols provided security for the British forces. The patrols scored successful kills on Argentine helicopters.[42] The Argentinians used low performance aircraft such as the Pucara to inflict damage on British helicopters. Neither side used helicopters with an aerial combat capability which might have turned the tables.

The Falklands demonstrated the capability of ground attack aircraft to pose a definite threat to helicopters. The capabilities of the weapon systems used in this conflict must be considered. The ability of the Harrier to perform at much slower speeds and lower to ground level may be the one significant advantage of fixed wing aircraft in aerial combat against helicopters. Low performance aircraft which are prop driven may have a distinct advantage. These aircraft are in the middle of the flight envelope between the high performance aircraft and the helicopter.

The feasibility of high performance aircraft conducting counterair operations against enemy attack helicopters is questionable. The capability of tactical fighter aircraft to counter threat helicopters with current weapon systems and tactics is limited. The findings of the J-CATCH tests suggest that when tactical aircraft are properly equipped they can counter an attack helicopter threat.[43] However, the costs for this commitment must be considered. The best solution for tactical fighters is a standoff/look down acquisition and use of shoot down weapons such as the AIM-9 missile. There are two current weapon systems with a look down/shoot down capability. They are the F-16 and F-15 aircraft. If the aircrews are to

survive against a well armed attack helicopter they must train accordingly. The best exchange ratio of 1.7 to 1 achieved with today's weapons and tactics is not encouraging in light of air-to-air missile technology.[44] In addition to problems encountered with antihelicopter operations one must consider the relative importance of the remaining Air Force missions. The Air Force is badly outnumbered in their fight for air superiority against other high performance aircraft. It is doubtful that assets other than A-10 and A-7 close support aircraft will be available for planned operations against enemy attack helicopters in a defensive or offensive counterair role.

IV. ARMY AVIATION IN THE AIR-TO-AIR ROLE

Army aviation units also have the capability to conduct aerial combat against the Soviet attack helicopter. The preceding section demonstrated major shortcomings in the air defense available for the Army's maneuver units. Current and future air defense systems are of questionable value in regard to the gaining and maintaining of air superiority over the battlefield. Army aviation is the one combat arm within the Army that can blend into the air defense operations of the Air Force and air defense artillery.

This section will analyze the capability of Army aviation forces to conduct air-to-air combat with enemy attack helicopters. It will address tactical doctrine, aerial combat flight tactics, and training as important ingredients to successful aerial combat engagements. The importance of aircraft technology as reflected by airframes and armament will be discussed.

The role of aerial combat is an extension of the ability to perform the traditional role of a maneuver unit within the combined arms team. The

tactical doctrine for the aerial combat role is presently being implemented in the aviation community. The new Field Manuals 1-111 and 1-112, for the Division Aviation Brigade and Attack helicopter battalion respectively have completely reversed the attitude toward aerial combat. The recently superceded how to fight manual for the attack helicopter battalion, FM 17-50, stated that air-to-air dogfights would be avoided.[45] The tactic was to lure the attacking helicopter into friendly air defense traps. It was not acceptable for an attack helicopter to attack enemy helicopters for the sake of attack alone. Air-to-air engagements will be swift and violent with little time to lure the enemy aircraft into a trap. FM 1-111 states that counterair operations will be a responsibility of the Aviation Brigade.[46] Aviation assets will complement ground based air defense and attack threat targets in staging areas, rearm and refuel points, and while enroute to target areas. The attack helicopter battalion is the primary means to conduct deliberate air-to-air combat in the close, rear, and deep operations of the battle.[47] The purpose of all three operational areas is the protection of the force. Air-to-air missions would be planned and conducted as any other mission. The mission of air-to-air combat could be either a stated or implied mission for the aviation unit commander. Training for the mission is already required by the attack battalion ARTEP manual. There are two air-to-air training tasks, one being a chance encounter, the other a deliberate air-to-air combat mission.[48] Field Manual 1-107, Air-to-air Combat, is being revised to incorporate better doctrine and tactics for the implementation of aerial combat training. Army aviation is evolving but the Soviets retain the initiative.

Use of the attack helicopter by both sides will eventually lead to multiple air-to-air engagements. The outcome of any rotary wing air-to-air combat

engagement will depend on a number of variables. The more important ones are tactics, crew training and determination, coupled with helicopter performance, firepower, and survivability.[49] The following paragraphs will discuss the influence of tactics, training, and equipment on the outcome of aerial combat.

Aerial combat must be planned for and constantly updated by aviation unit commanders. All aircrews must be prepared to encounter enemy helicopters in the air-to-air combat role. Aircrews are trained to engage the most dangerous threat posed to them. In most cases they will find the greater threat to be the enemy attack helicopter. It must be countered first and eliminated quickly. In a mid-intensity conflict, there will be numerous aerial dogfights. Army aviation units must have a better capability to attack the Soviet helicopter threat than that provided by existing weapon systems. Beyond acceptance, preparation and readiness, aerial combat is vital to achieving overall success for the combined arms team.

Tactics used by crew members will be a determining factor for their survival in aerial combat. Army aviators must know their own limitations and those of their adversary. Speed and surprise are the two most important principles of an aerial engagement.[50] Soviet crews will attempt to achieve surprise by attacking in the blind spot of a helicopter. If a helicopter attacks with the element of surprise against a slow moving or stationary target, the pilot is assured of a kill. The Soviets believe the first attack has decisive significance and surprise will be a major factor.

Speed is associated with the terrain and the tactical situation. The closer an aircraft flies to nap of the earth, the slower it will fly. Therefore, speed is dependent on altitude. Altitude is determined by the capability of the enemy air defense systems. If the situation is in a friendly rear area, the

helicopter can achieve greater speed because it can fly higher without fear of the enemy's ground air defense systems. On a deep attack it might be difficult gaining enough altitude to build inertia for greater maneuverability without becoming vulnerable to a greater density of threat air defense systems.

A study was conducted by Flight Systems Incorporated regarding the assessment of speed versus survival in a helicopter aerial engagement. The study pitted current U.S. Army helicopters against Soviet helicopters. The study found that as speed increased the probability of survival decreased.[31] The results apparently reflected the aerodynamic features of the HIND. The AH-1 Cobra is more maneuverable than the HIND but not as fast. The HIND is not designed to be a stable weapons platform at a hover. This is why it would be advantageous for AH-1 crews to fly slower, enabling them to remain in the flight envelope where they are most maneuverable. The Soviets also believe that aerial combat between helicopters is considered to be mobile because an energetic maneuver is the best means of going into the region of possible weapon use and of evading enemy attack. [32]

Training is the key to successful aerial combat. Currently there is a lack of air-to-air combat training in army aviation. The Marine Corps has established a Marine Aviation Weapons and Tactics Squadron to train crews in aerial combat. A great deal of experience is gained from their knowledge in aerial combat training between helicopters and helicopters versus fixed wing aircraft.[33] They not only conduct one on one training but also conduct free play two on one engagements. In addition, two Army air cavalry squadrons, one with the 101st Air Assault Division and the other with the 9th Motorized Division, have established air-to-air programs on their own initiative. They have helped to establish the Army standards for aerial

combat training. These aerial combat training programs have established the need to make changes in current air crew training manuals. These changes must focus on basic and advanced individual maneuvers. Training is an important task because an aviator must develop reflexive responses to enemy actions. A 'fighter' helicopter pilot must perform multiple maneuvers that must be automatic. They must be executed without thinking. This situational awareness can only be established with sound, realistic, and highly structured aircrew training.[54]

There are valuable lessons to be learned from the Air Force in the conduct of their training during the Korean and Vietnam war. The kill ratio during the Korean conflict was in excess of 10 to 1.[55] Most of the pilot's training was spent in air-to-air practice. Pilots remarked that they would conduct air-to-air combat training when they were supposed to do navigation exercises and then log the time as navigation. Pilots who flew in Korea remarked that the greatest attribute of Air Force success was the man using the known strength of the machine against a foe who was not as well trained. Following the Korean war the lack of air-to-air combat training led to problems. Neglect of air-to-air combat training led to kill ratios of 2.3 to 1 during the initial years in Vietnam. The Navy established a training school for aerial combat, Top Gun in California. This was an attempt to emphasize the techniques of aerial combat through rigorous training. This school resulted in a considerably better ratio. The ratio climbed to 12.5 to 1 for the Navy, while the Air Force ratio continued to decline.[56]

An aviator's ability is increased with the amount of time spent in realistic training. Individual air crew training maneuvers are not complete training. The training plan that is adopted must be geared to the development of a maneuver oriented aviator. Aviators must work in teams so they learn to

rely on one another. A great deal of training time must be spent beyond the individual level. Crew and team training is as important as individual skills in insuring survivability. The training plan should include dissimilar aircraft. An attack helicopter battalion of AH-64's should not train against a company of AH-1s but against a helicopter similar to the HIND or HOKUM. Crew members must learn their personal limitations and capabilities as well as the capabilities of their aircraft. This will be accomplished only through realistic sustained training. Success will depend on the skills and teamwork of the crew the majority of the time.

Equipment for aerial combat is the final critical ingredient for successful engagements. The equipment category is subdivided into airframe and armament. The characteristics of an airframe are best stated by Colonel Belov of the Soviet army. He suggests that the fighter helicopter must be light, have high speed, and be very maneuverable. It should be armed with a cannon and air-to-air guided missiles.[57] His fighter helicopter sounds very similar to the HOKUM. Of interest in this regard is the way the Air Force evolved from the F-86 to the F-16. The F-86 utilized in the Korean war was a light, very maneuverable aircraft, with a cannon weapon system. The pilots in the Vietnam war fought in the F-4 which was a heavy, slow aircraft with only an air-to-air missile system. The cannon on the F-4 was not added until the Air Force learned its lesson against the more maneuverable MIGs over North Vietnam.[58] Now the Air Force has developed a multipurpose fighter that is light, has high speed, and is very maneuverable. It is armed with cannon and an air-to-air missile system. It is of interest how this equipment and the combat results noted in preceding paragraphs relate to each other.

Helicopters must have a better armament system to provide a capability of defeating helicopters and other aerial targets. An air-to-air missile and a cannon is needed on each attack helicopter. The lack of either weapon would force the aircraft to operate in a defensive mode only. Air-to-air missiles may be fired at ranges of 5 kilometers with outstanding effect. These missiles have little effect at ranges under 1000 meters. Most helicopter aerial combat will occur within 1000 meters. This is based on unexpected engagements while conducting nap of the earth flight. Antitank guided missiles can be used in the air-to-air role but they are slow. A TOW should be fired at targets that are either stationary or moving toward or away to the attacker because of the slow lateral tracking capability of the missile. A helicopter with a missile system and no additional armament will have two major shortcomings. The minimum engagement range is one. The need for the helicopter to point directly at the target prior to launch is the second.

Cannon fire can be employed out to 2000 meters. With the addition of a helmet sub-system the turreted cannon can be employed with remarkable effectiveness while maneuvering. An air-to-air gun system must have a high rate of fire that will give it a higher probability of kill.[59] Also, the larger round will give the helicopter a longer engagement range and will cause more damage. The M-197 20mm mounted on the AH-1S (MC) is adequate in dealing with the HIND. A proposal to double its rate of fire to 1,500 shots per minute would significantly increase its air-to-air lethality.

The airframes within Army aviation units have a limited aerial combat capability. The AH-1 Cobra lacks survivability especially in its limited armor protection. It lacks the speed to fight the HIND, not to mention the HAVOC or HOKUM. The crew members in the Cobra must rely on stealth and maneuverability to survive against the Soviet helicopters.[60] The AH-64 is

invulnerable to heavy machine gun fire of 12.7mm and resistant to light cannon fire(23mm). It currently lacks air-to-air fire control capability and air-to-air missile installation. Because of its low rate of fire, the Soviets believe the cannon has a defensive air-to-air capability only.[61] This problem should be resolved easily. Poor rearward visibility and a large profile degrade the Apache's ability in an air-to-air encounter. The survivability of the crew members is questionable because the canopy is not bullet resistant. The cannon has a limited upward fire capability for close in engagements which is a major drawback. The AH-64 represents a true flying tank but it is not a fighter helicopter. It lacks the quickness, small profile and dedicated fire control. Also, AH-64 does not possess the airspeed for future aerial combat with the HOKUM.

The future LHX has the prerequisites to become a match for the Soviet helicopters in aerial combat.[62] It will have an airspeed over 200 knots with an endurance of more than three hours. It will have excellent maneuverability for aerial combat with a g-load range of -1.5 to +3. The scout attack version of the LHX will have multiple ordnance possibilities. It can mount Helifire missiles, spike (hypervelocity) missile, Stinger air-to-air missiles, and a 25 or 30mm cannon for armament. The radar warning receiver will give it the advantage in acquisition and deny the element of surprise to the threat. Army attack helicopters must maintain the pace with the Soviets. A superior fighter helicopter in the near future can sway the tactical advantage in the aerial dogfight.

V. CONCLUSION

In the interest of protecting their superior armored formations from a significant NATO antitank helicopter threat, the Soviets have modified and equipped attack helicopter units with an air-to-air capability. With their superior numbers of attack helicopters, including those optimized for the air-to-air role, the Soviets have the capability to protect their advancing armored motorized forces by seeking out and attacking defending attack helicopters and/or close air support aircraft.[63] Destroying helicopters is not the primary mission of the HIND nor possibly the HAVOC. Their air-to-air engagements will probably occur as part of a target array within their objective area. The HOKUM, on the other hand, is designed to destroy enemy helicopters in order to protect Soviet forces. The Soviet move to specialized aircraft in the air superiority role will neutralize one of the U.S. Army's most effective antitank weapon systems. Measures must be taken to counter this threat. If the Soviet helicopter forces are successful they will free the Soviet fighter-bomber aircraft for interdiction and air superiority operations. If the Soviet helicopter forces are not degraded, Soviet close air support assets can interdict the friendly air defense artillery and field artillery units at will. This will allow a Soviet offensive to be launched with a much greater probability of success. The Soviets cannot be allowed to strip away friendly assets -- attack helicopters, field artillery, air defense, and combat vehicles -- in a piecemeal fashion relieving their armored forces of their concern for the synergism of a combined arms defense. The outcome of the helicopter aerial combat may have significant influence on the outcome of the total battle.

Fighting the helicopter in the nap of the earth environment makes it necessary to use every available weapon system to destroy it. The ability of the Air Force and air defense artillery to achieve protection of maneuver forces against attack helicopters appears to be highly questionable. Army aviation forces must assist in the protection of the combined arms team. They can assist in the air defense arena by adding strength to the known weaknesses of the air defense artillery. The mobility of the helicopter would allow it to defend where mobility is difficult for air defense assets, where scarcity of resources results in gaps in area coverage, or where enemy concentration overwhelms scarce resources. The line of sight problem is not a concern for the helicopter because of its vertical maneuverability. Finally, while range is a major problem, the helicopter has the ability of closing within range of a enemy helicopter.

Army aviation forces must assist the Air Force in the conduct of the counterair campaign to insure the protection of friendly assets. The Air Force lacks the numbers of weapon systems to achieve a credible defense against Soviet attack helicopters. High performance aircraft have difficulties in acquiring and engaging the helicopter. Another well-armed helicopter is the best weapon to destroy the like weapon system. The Army does not want to assume the role of the Air Force in gaining air superiority over the battlefield. The issue of the helicopter's ability to attack a high-performance aircraft is beyond the scope of this monograph. Even though this issue is not fully proven in actual combat, it is obvious that a helicopter can defend itself against high-performance aircraft. Helicopter units can definitely assist the Air Force in defensive counterair operations, particularly against rotary wing aircraft. Including Army aviation units in the counterair plan allows the theater commander the flexibility to commit his high performance Air Force

assets where they may be better employed. The defensive counterair role for Army aviation is established. Should Army aviation also conduct part of the offensive counterair campaign?

Army commanders should consider offensive counterair operations as a major functional area in the conduct of airland battle. Attrition warfare in regard to aerial combat is not the way to success. Waiting to slug it out, force on force, will bear a heavy cost. The offensive counterair operation would destroy the threat where it is the most vulnerable. It would limit the Soviet sortie generation capability by destroying aircraft on the ground or destroying their logistical capability. Army aviation units should conduct joint offensive counterair operations with the Air Force. They cannot conduct this operation of their own. An offensive counterair operation would be planned and conducted the same as any deep operation. Cross FLOT operations require coordination with Air Force assets to incorporate suppression of enemy air defense, electronic warfare aircraft, and close air support.

Should the Army dedicate an aviation unit to destroy enemy attack helicopters? What are the criteria for the establishment of a dedicated aviation unit with the primary purpose of aerial combat? First, the current mission must always have priority. Army aviation's primary occupation is the business of killing tanks. To have a dedicated aviation unit requires some cost. This cost must be measured in terms of mission success.

The ability of Army aviation to survive and win in aerial combat must be considered. Tactics must be updated and continually evaluated through joint service and combined arms testing. Army helicopters are outnumbered so they must achieve a greater than equal kill ratio to win. To achieve this goal, sound and aggressive tactics must be established. The key to success is

training the individual aviator in situations unique to air-to-air combat. These tasks must be accomplished with sound individual, crew, and team training. A great deal must be considered with aerial combat training. For example, training should be geography-specific. It will require an opposing force of dissimilar aircraft. It must be sustained at the unit level. Training poses difficult challenges to be resolved by all helicopter units in the Army.

Equipment for aerial combat must be equal to the threat. This opens the question of the advantages of multipurpose and special purpose airframes. The multipurpose helicopter can perform multiple missions simultaneously. One may view this as a weakness, for this approach ordinarily pays a cost in effectiveness under certain conditions in any particular role. The special purpose approach seeks technology to build the most effective aircraft for each specific role. The capabilities required for a good air-to-air helicopter have already been specified. The Soviets have begun to investigate the utility of special purpose aircraft with the HAVOC. It is designed like the AH-64 with the antitank role as its primary purpose. It also has developed an air-to air weapons capability. The HOKUM is believed to have been designed as an air superiority helicopter with the antitank capability as its secondary purpose.

There are also trade-offs required in weapons systems. A multipurpose helicopter will not carry the maximum amount of any single type of ordnance because of gross weight limitations. Therefore, it cannot do both missions with the same effectiveness as more specialized systems. Until it is possible to field multipurpose ordnance, this problem will not be resolved. What is provided is a balance of killing power and protection. It will take two special-purpose aircraft to get the benefits of one multipurpose aircraft. But is it possible to survive without an aircraft to match the enemy threat?

Flexibility may be lost but more weapon systems may survive. The best possible choice is to have a multipurpose aircraft for simplicity and to reorganize for different missions.

Army aviation should not dedicate a unit to aerial combat if existing units can handle the Soviet helicopter threat in the conduct of their primary mission. This assumes that attack helicopters assigned to air cavalry squadrons and attack battalions can perform the air-to-air combat mission. Air-to-air combat is now accepted practice and all aviation units will train for this contingency. The Army has decided to arm all combat helicopters with an air-to-air missile. There is no cost to mission accomplishment if all units can perform their primary mission and aerial combat when required by enemy action.

There are, however, numerous difficulties if existing units handle aerial combat in addition to other missions. Besides the twin problems of needing a mixed ordnance load to conduct both missions and having only limited flight hours devoted for aviation training, the primary issue is whether a unit can conduct two actions simultaneously. The comments from aviators participating in the Army Air-To-Air Combat I tests indicate that they felt it was impossible properly to conduct a screen mission and orient on counterair operations at the same time. [64] In the Falklands conflict, British helicopters were flown by a single pilot. A dual mission, therefore, posed similar problems. When attacked by the Argentine Pucara, the pilots had to devote their full attention to aircraft control and did not have the ability for any other task.[65] To allow the Soviets' the initiative to attack first would place friendly aviation units on the defensive. The end result is the maneuver commander's scheme of maneuver will probably be disrupted by the enemy forcing friendly aviation units to conduct another mission. The

cost of this may be excessive.

The demands of training and equipment are best met by the establishment of a dedicated aviation unit. Training for air-to-air combat operations are demanding. A high technology special purpose airframe especially designed for aerial combat requires a dedicated unit to employ it. A dedicated organization may also be necessary for employment of a multipurpose airframe because the extra weight introduced by a mixed armament load may restrict the airframe performance envelope. A dedicated aerial combat unit could conduct missions of protecting the force, augmenting unit air defense capabilities, and complementing the Air Force in its role of maintaining local air superiority.[66]

One method of dedicated organization would allow an aviation unit commander to task-organize his unit. The commander would decide if a portion of his organization should be dedicated to the air-to-air role. Training is the major reason for this philosophy. The Germans organized their Stuka squadrons in a similar fashion during World War II.[67] A normal aircraft mix employed against Soviet armored organizations were two aircraft tasked as antitank ships, two aircraft tasked as fire support against ground air defense, and two aircraft tasked for air-to-air protection. The entire flight's primary mission was antitank and it was normally very successful.

Adopting this solution, a commander would set up a section or platoon within his unit that would concentrate on aerial combat. This would not be their only mission but their emphasis would be on this particular mission. They would become the experts on air-to-air combat through rigorous training. The remainder of the unit would train on the required aircrew proficiency tasks for aerial combat but not focus on this area.

When a mission such as a cross-the-FLOT raid or antitank suppression occurred, the aviation unit commander would assign his aerial combat platoon the responsibility of flying combat air patrol. This would insure that the bulk of the unit could execute the antitank mission. The aerial combat platoon would focus on protecting their sister platoons by attacking enemy helicopters or air defense units that might disrupt the overall mission. This would add synergism and agility to the engagement. The cost of dedicating such a unit would benefit the overall mission accomplishment by protecting the force.

Another option for dedicated air-to-air units would be to change the force structure in the Corps aviation brigade. The primary purpose of this unit would be air-to-air combat with tank killing a secondary requirement. This is the preferred option if the Army developes a special purpose aircraft.

An organizational model proposed by Greg Hampton in Armor magazine, sets the standard for this type of organization.[68] His suggestion is to focus the aerial combat role in one unit at the Corps level. His recommendation is based on the fielding of the LHX in the 1990's. The unit would be battalion sized and assigned to the Corps aviation brigade. Its primary mission would be to destroy aerial targets. It would have secondary roles of tank killing, reconnaissance, or fire support. The unit's training and organizational arrangements would focus on the primary mission of offensive air-to-air operations. If the Corps commander deemed it necessary, the battalion could be attached or placed under operational control of a division. The battalion would have four companies, each with 10 (SCAT) scout/attack versions of the LHX aircraft. In this manner one could exploit the advantages of the LHX in aerial combat. The LHX will have the aircraft characteristics to challenge the threat helicopters in the low altitude air superiority role.

The costs of dedicating this organization to an aerial combat role are minimal, although 40 weapon platforms are concentrating on fighting helicopters and air defense units instead of conducting the antitank mission. The benefits that will accure from this organization will far outweigh the costs.

This point can be demonstrated in evaluating a scenario where the Corps combat aviation brigade is assigned a mission to destroy a second echelon tank regiment. The aerial combat battalion will be part of the Corps attack group configured to kill tanks. Hypothetically, with the appropriate combined arms attached, the friendly force would achieve a reasonable kill ratio of 10 tanks to 1 helicopter. When the Soviets employ their security forces of HAVOCs or HOKUMs to disrupt the friendly engagement the ratio will fall. In fact, the antiarmor mission may be cancelled completely. This aborted mission is caused by the need for the attack helicopters to change positions to avoid or engage the Soviet aircraft.

Now picture the scenario with the aerial combat battalion a part of the same Corps attack group with a dedicated aerial combat mission. If a Soviet airborne threat is present the aerial combat unit will be committed. This would allow the AH-64's to focus on the destruction of the tank regiments. Even a partial aerial combat success would allow the attack aircraft to service their targets longer. The kill/loss ratio would remain at 10 to 1 or higher for the entire engagement time. Overall, this would achieve mission accomplishment with minimal losses.

Army aviation must continue to improve the theory of helicopter aerial combat. More testing must be accomplished with force-on-force combined arms engagements and joint exercises. It is also important to consider every option to include that of adding a prop-driven Army or Air Force air-to-air

combat unit. The Harrier, OV-10, Mohawk, or V-STOL aircraft may achieve outstanding results against an attack helicopter. All options must be continually considered.

Army aviation must be prepared to fight for the control of the air so it can exploit its use. Mission accomplishment will be the definition of success. Without the appropriate training, equipment, and dedicated aircrews this responsibility of Army aviation to the combined arms community will not be fulfilled.

ENDNOTES

1 Colonel M. Belov, "How to Fight Helicopters," U.S. Army Aviation Digest. (October 1981): 21.

2 U.S., Department of the Army Field Manual, Operations FM 100-5. (Washington,D.C.,1986): 48.

3 LTG Robert W. RicCassi, " Army Aviation in the 80's." U.S. Army Aviation Digest. (January 1986): 8.
Gen. John A. Wickham, jr. " The Challenges We Face." Army Aviation. (May1986): 56.
Gen. Carl E.Vuono, Letter to LTG Gerald Bartlett, Commander United States Army Combined Arms Center. August 1986. This letter addresses the CSA's approval of the air-to-air concept statement and instructs LTG Bartlett to oversee the operational concept which will provide options for the employment of Army Aviation in counterair operations.
Gen. John A. Wickham, jr. Letter to Gen William R. Richardson, Commander U.S. Army Training and Doctrine Command. June 1985. This letter discusses the serious threat that enemy helicopters pose to air and ground maneuver units. General Wickham instructs General Richardson to aggressively develop operational concepts, doctrine, and combat development initatives to meet the need for air-to-air combat. He relays that General Gabriel, Chief of Staff of the Air Force, agrees with the approach.

4 U.S., The Joint Chiefs Of Staff, Joint Doctrine For Theater Counterair Operations Publication 26, (Washington, April 1986): III-1.

5 Ibid, p. IV-1.

6 Belov, p. 21.

7 Viktor Suvorov, Inside the Soviet Army. (New York: MacMillian Publishing Company, 1982): 191-192.

8 John Everett-Heath, Soviet Helicopters. (London: Jane's Publishing Company Limited, 1983): 128.

Francis A.Tichauer and Fred V. Carpenter, " How to Counter the Soviet Hind(Mi-24) Helicopter." Report for United States Army Command and General Staff College, Ft. Leavenworth, Ks. (18 May 1981): 1.

9 Tichauer and Carpenter, p. 4.

10 Steven R. Bowman, "Soviet tactical Air Support of Ground Forces," Defense Intelligence Agency, (January 1980): 4.

11 U.S., Department of Defense, Soviet Military Power 1985, (Washington, 1985): 77.

12 "The Worlds Military Helicopter Fleet and It's Predicted Growth to 1990," Interavia, volume 34, (July 1979): 688.

13 Erich Sobik, " Soviet Helicopters." Translated by Terry M. Hill. Wehrausbildung in Wart und Bild; Germany F.R. (1981): 6.

14 Maj Charles B. Cook, " An Assessment of the Soviet Combat Helicopter Threat." Master of Military Art and Science Thesis, Ft. Leavenworth, Ks. (1982): 127.

15 Soviet Military Power 1985, p. 64.

16 U. S., Department of the Army Field Manual, The Soviet Army: Troops, Organization, and Equipment FM 100-2-3. (Washington, D.C., 1984): 5-173 & 5-180-181.

17 Maj Stephen R. Baribeau, " Soviet Attack Helicopters and Their Implications for U.S. Army Division Operations." School of Advanced Military Studies, U.S. Command and General Staff College. (December 1985): 17.

18 Nikolai Cherikov, "The Soviet Mi-24 HIND Attack Helicopters." International Defense Review. (September 1981): 1134.

19 Nikolai Cherikov, " The Soviet Mi-28 Combat Helicopter." International Defense Review, volume 17, number 10 (1984): 1455.
Mark Lambert, " The Soviets Create Havoc." Interavia, (January 1985): 44-45.

20 Soviet Military Power 1985, p. 65.

21 "Soviet Helicopters Update," Air Defense Artillery, Summer 1986: 59.

22 Cherikov, p. 1131.
Soviet Military Power 1985, p. 65.

23 Baribeau, p. 18.

24 Col V. Babich and Lt Col Yu. Kislyakov, "Development of the Principles of Air Combat," Soviet Military Review, May-August 1981)

25 U.S., Congress, Congressional Budget Office. Army Air Defense for Forward Areas: Strategies and Costs, by Frances M. Lussier. Prepared for the House Committee on Armed Services. (Washington, D.C. Government Printing Office, June 1986): xii.

26 Army Air Defense for Forward Areas: Strategies and Costs, p. 8-11.

27 U.S., Department of the Army Field Manual, Air Defense Artillery Employment: Chaparral/Vulcan/ Stinger FM 44-3. (Washington, D.C., 1984):
1-2.

28 Army Air Defense for Forward Areas: Strategies and Costs, p. 13-14.

29 Ibid, p. 14.

30 Ibid, p. 16 & xiii.

31 Ibid, p. A-1.

32 Ibid, p. 57-58.

33 U.S., Department of the Air Force Manual, Tactical Manual 2-1, (Langley AFB, Va., 1978): 4-23.

34 Willard P. Kramer, "Tactical Air Power vs Attack Helicopters," Report for United States Army Command and General Staff College, Ft. Leavenworth, Ks. (May 1980): 24.

35 Lt Col G. Dovgalyonok, "Intercepting Low/Slow Targets," Soviet Military Review, (June 1982).

36 Kramer, p. 25.

37 Maj Robert P. Demers, "Unarmed Helicopter Evasive Options in Helicopter Air to Air Attacks." Air Command and Staff College; Maxwell AFB, Al. (1984): 21.

38 Kramer, p. 46.

39 Ibid, p. 48.

40 The Soviet Army: Troops, Organization, and Equipment FM 100-2-3, p. 5-80.

41 Kramer, p. 50.

42 Max Hastings and Simon Jenkins, . The Battle for the Falklands. (New York: W.W. Norton and Company, 1983): 206 & 214.

43 Kramer, p. 50.

44 Ibid, p. 53.

45 U.S., Department of the Army Field Manual, Attack Helicopter Operations FM 17-50. (Washington, D.C., 1984): E-6&7.

46 U.S., Department of the Army Field Manual, Combat Aviation Brigade FM 1-111. (Washington, D.C., August 1986): 5-8.

47 U.S., Department of the Army Field Manual, Attack Helicopter Battalion FM 1-112. (Washington, D.C., August 1986): D-1.

48 U.S., Department of the Army Training and Evaluation Program, Attack Helicopter Battalion ARTEP 17-385. (Washington, D.C., 1984): 3-246.

49 John Everett-Heath, "Helicopter Air Combat," International Defense Review. (May 1984): 604.

50 Maj Fred E. Brown, " Armed Helicopter to Helicopter Engagement Methods." Report number 84-0320, Air Command and Staff College, (Maxwell AFB, Al. 1984): 21.

51 Brown, p. 20.

52 Maj. Gen M. Fesenko, " Helicopter versus Helicopter." Aviatsiya Kosmonavtika, no. 3 (1984): 46.

53 U.S., Marine Corps, Helicopter Air Combat Maneuvers Guide, (Yuma, Az. August 1986): Chapters 5&6.

54 Ibid, p. 3-11.

55 Walter L. Van Glider, "Realistic Training: The Key to Success in Aerial Combat, Master of Military Art and Science Thesis, (Ft. Leavenworth, Ks.,1979): 7.

56 Ibid, p. 29.

57 Belov, p. 22.

58 Van Glider, p. 24.

59 Mario Acevedo and Greg Hampton, "Helicopter Aerial Combat Week," U.S. Army Aviation Digest,(August 1982): 30.

60 Greg Hampton, "Attack Helicopter Air-to-Air Employment Options, Armor Officers Advanced Course Project, (Fort Knox, Ky., April 1983): 49.

61 Fesenko, p. 46.

62 Hampton, p. 57.

63 Maj Charles B. Cook, " An Assessment of the Soviet Combat Helicopter Threat." Master of Military Art and Science Thesis, (Ft. Leavenworth, Ks., 1982): 144.

64 Counterair Working Conference, Combined Arms and Training Activity, Fort Leavenworth, Kansas 21 November 1986.

65 Maj Robert P. Demers, " Unarmed Helicopter Evasive Options in Helicopter Air to Air Attacks." Air Command and Staff College, (Maxwell AFB, Al., 1984): 15.

66 Maj Frank E. Babiasz, " The Fighter/Interceptor Helicopter." U.S. Army Aviation Digest, (January 1982): 32.

67 Hans Ulrich Rudel, Stuka Pilot. Translated by Lynton Hudson. (New York: Ballantine Books, 1958): 86.

68 Cpt Greg R. Hampton, " The LHX Pursuit Helicopter Squadron." Armor. (May-June 1983): 26-29.

BIBLIOGRAPHY

BOOKS & MANUALS

Doughet, Giulio. The Command of the Air. Translated by Dino Ferrari. Coward- McCann Inc., 1942; reprinted ed., Office of Air Force History, 1983.

Gabriel, Richard A. Operation Peace for Galilee. Toronto: Collins Publishers, 1984.

Everett-Heath, John. Soviet Helicopters. London: Jane's Publishing Company Limited, 1983.

Hastings, Max and Jenkins, Simon. The Battle for the Falklands. New York: W.W. Norton and Company, 1983.

Rudel, Hans Ulrich. Stuka Pilot. Translated by Lynton Hudson. New York: Ballantine Books, 1958.

Suvorov, Viktor. Inside the Soviet Army. New York: MacMillian Publishing Company, 1982.

U.S., Department of the Air Force Manual, Basic Aerospace Doctrine of the United States Air Force 1-1. Washington, D.C., 1984.

U.S., Department of the Air Force Manual, Tactical Manual 2-1. Langley AFB, Va., 1978.

U.S. Department of the Army Field Manual, Combat Aviation Operations FM 1-100. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Aircraft Battlefield Countermeasures and Survivability FM 1-101. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Air to Air Combat FM 1-107. Washington, D.C., 1984.

U.S. Department of the Army Field Circular, Combat Aviation Brigade FM 1-111. Fort Rucker, Al., 1985.

U.S. Department of the Army Field Manual, Aviation Brigade FM 1-111. Washington, D.C.1986

U.S., Department of the Army Field Manual, Attack Helicopter Battalion FM 1-112. Washington, D.C., 1986.

U.S. Department of the Army Field Manual, Attack Helicopter Operations FM 17-50. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Cavalry FM 17-95. Washington, D.C., 1980.

U.S. Department of the Army Training and Evaluation Program, Attack Helicopter Battalion ARTEP 17-385. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Air Defense Artillery Employment FM 44-1. Washington, D.C., 1983.

U.S. Department of the Army Field Manual, Air Defense Artillery Employment: Chaparral/Vulcan/ Stinger FM 44-3. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Small Unit Air Defense Against Air Attack FM 44-8. Washington, D.C., 1981.

U.S. Department of the Army Field Manual, Air Defense Artillery Employment: Sgt York Gun/Stinger FM 44-11. Washington, D.C., 1985.

U.S. Department of the Army Field Manual, The Soviet Army: Operations and Tactics FM 100-2-1. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, The Soviet Army: Specialized Warfare and Rear Area Support FM 100-2-2. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, The Soviet Army: Troops, Organization, and Equipment FM 100-2-3. Washington, D.C., 1984.

U.S. Department of the Army Field Manual, Operations FM 100-5. Washington, D.C., 1986.

U.S. Department of Defense, Soviet Military Power 1985, Washington, D.C.,1985.

U.S. The Joint Chiefs Of Staff, Joint Doctrine For Theater Counterair Operations Publication 26, Washington, D.C.,1986.

U.S. Marine Corps, Helicopter Air Combat Maneuvers Guide, Yuma, Az. 1986.

REPORTS

Baribeau, Maj Stephen R. "Soviet Attack Helicopters and Their Implications for U.S. Army Division Operations." School of Advanced Military Studies, U.S. Command and General Staff College. December 1985.

Bowman, Steven R. "Soviet tactical Air Support of Ground Forces," Defense Intelligence Agency, Washington, D.C. January 1980.

Brittingham, Maj Michael L. "Attack Helicopter Employment Options," Master of Military Art and Science Thesis, Ft. Leavenworth, Ks. 1980.

Brown, Maj Fred E. "Armed Helicopter to Helicopter Engagement Methods," Report number 84-0320, Air Command and Staff College, Maxwell AFB, Al. 1984.

Canby, Steven L. " Classic Light Infantry and New Technology," Research for the Defense Advanced Research Project Agency, Arlington, Va., . Contract number MDA 903-81-C-0207. 1981.

Cook, Maj Charles B. " An Assessment of the Soviet Combat Helicopter Threat," Master of Military Art and Science Thesis, Ft. Leavenworth, Ks. 1982.

Demers, Maj Robert P. " Unarmed Helicopter Evasive Options in Helicopter Air to Air Attacks," Air Command and Staff College; Maxwell AFB, Al. 1984.

Hood, Maj Carlton L. " Determining the Optimum Aviation Organization for the Operational Level of War," Master of Military Art and Science Thesis; Ft. Leavenworth, Ks. 1984.

Kramer, Willard P. "Tactical Air Power vs Attack Helicopters," Report for the United States Army Command and General Staff College; Ft. Leavenworth, Ks. 1980.

Pool, LTC Lloyd G. "The Role of the Helicopter in Air to Air Combat," (S) Air Command and Staff College; Maxwell AFB, Al. 1979.

Puster, Maj John and Walker, Cpt Harry. "The Cannon vs the Chopper," (S) J-CATCH Final Report Phases I-IV; Nellis AFB, NV1980.

Semmens, Maj E. Paul. "A Crisis in Chapparral/Vulcan Employment," Report for United States Army Command and General Staff College; Ft. Leavenworth, Ks. 1981.

Sobik, Erich. "Airborne Troops and Helicopter Operations: Two Components of a Constant Soviet Airborne Threat," Translated by J. Crabbs. Kampftruppen, Kampfunterstuetzungstruppen; Germany, F.R. 1981.

Sobik, Erich. " Soviet Helicopters," Translated by Terry M. Hill. Wehrausbildung in Wart und Bild; Germany F.R. 1981.

Stalder, Maj Keith J. "The Air War in Afghanistan," Report for the United States Marine Corps Command and Staff College; Quantico, Va. 1985.

Tichauer, Francis A. and Carpenter, Fred V. " How to Counter the Soviet Hind (Mi-24) Helicopter," Report for United States Army Command and General Staff College, Ft. Leavenworth, Ks. 1981.

U.S. , Congress, Congressional Budget Office. Army Air Defense for Forward Areas: Strategies and Costs, by Frances M. Lussier. Prepared for the House Committee on Armed Services. Washington, D.C. Government Printing Office, june 1986.

Van Gilder, Walter L. "Realistic Training: The Key to Success in Aerial Combat," Master of Military Art and Science Thesis; Ft. Leavenworth, Ks. 1979

JOURNAL ARTICLES

Acevedo, Mario and Hampton, Greg R. "Helicopter Aerial Combat Week." U.S. Army Aviation Digest, August 1982.

Alder, Konrad. "The Airborne Threat to Mechanized Units." Armada, December 1985. pp. 118-142.

Babiasz, Maj Frank E. "The Fighter/Interceptor Helicopter." U.S. Army Aviation Digest, January 1982.

Babich, Col V. and Kislyakov, Lt Col Yu. "Development of the Principles of Air Combat," Soviet Military Review, 1981.

Bavaro, Ed. "Soviet Combat Helicopters Today." U.S. Army Aviation Digest, June1984, pp. 30-34.

Bavaro, Ed. "Soviet Helicopter Armament." U.S. Army Aviation Digest, November 1984, pp. 34-37.

Belov, Col. M. "Soviet Helicopter Threat." U.S. Army Aviation Digest, January 1981, pp. 45-48.

Belov, Col. M. " How to Fight Helicopters." U.S. Army Aviation Digest, October 1981, pp. 20-22.

Brittingham, Maj Michael L. and Hampton, Cpt Greg R. "Aerial Combat." U.S. Army Aviation Digest, May 1984. pp. 2-8.

Byars, Cpt Napoleon B. "Getting Together on Air Defense." Air Force Magazine, July 85. pp. 112-114.

Casper, Maj Lawrence E. "Force Protection-Aerial Combat." U.S. Army Aviation Digest, April 1986. pp. 2-5.

Cherikov, Nikolai. "The Soviet Mi-24 HIND Attack Helicopters." International Defense Review, September1981. pp. 1131-1134.

Cherikov, Nikolai. "The Soviet Mi-28 Combat Helicopter." International Defense Review, volume 17, number 10 (1984). pp. 1455-1458.

Condom, Pierre. "Helicopter vs Helicopter." Interavia, November 84. pp. 1173-1174.

Donnelly, C. N. "The Soviet Helicopter on the Battlefield." International Defense Review, volume 17, number 5 (1984). pp. 559-566.

Dovgalyonok, Lt Col G. "Intercepting Low/Slow Targets," Soviet Military Review, 1982.

Everett-Heath, John. "Soviet Helicopter Combat Doctrine." Jane's Defense Weekly, 1984. pp. 333-336.

Everett-Heath, John. "Helicopter Air Combat." International Defense Review, volume 5, (May 1984). pp. 603-609.

Fesenko, Maj-Gen M. "Helicopter versus Helicopter." Aviatsiya Kosmonavtika, no. 3, 1984. pp. 46-47.

Gilson, Charles. "Helicopter Air to Air Combat." International Defense Review, volume 19, number 1 (1986). pp. 81-86.

Goodson, Betty J. "Victory in Air to Air Combat, the Marine Corps Way." U.S. Army Aviation Digest, July 1982. pp. 2-7.

Hampton, Cpt Greg R. "The LHX Pursuit Helicopter Squadron." Armor, May-June 1983. pp. 26-29.

Johnson, Robert M. "Soviet Attack Helicopter." Armor, September-October 1979. pp. 23-25.

Lambert, Mark. "The Soviets Create Havoc." Interavia, January 1985. pp. 44-45.

Lambert, Mark. "Helicopters prepare for air combat." Interavia, May 1985. pp. 445-447.

Lambert, Mark. "First Havoc, now Hokum." Interavia, July 85. pp. 798-799.

Lappos, Nick. "Guns in Helicopters - Will existing gun systems do?" Interavia, April 86. pp. 395-397.

Nelson, LTC Denny R. "Soviet Air Power: Tactics and Weapons Used in Afghanistan." Air University Review, Jan-Feb 85. pp. 30-44.

Pochhacker, Christian. "Low Level Air Defense Aircraft Hunter." Defense Update International, volume 70 (1985). pp. 10-17.

RicCassi, LTG Robert W. "Army Aviation in the 80's." U.S. Army Aviation Digest, January 1986. pp. 2-8.

Sikorsky, Sergei. "From Hind to Havoc." Air Force Magazine, March 85. pp. 88-95.

Simmons, Dr. L. Dean. "Helicopter Operations in the South Atlantic." Marine Corps Gazette, May 1984. pp. 76-81.

Talmon, Peter. "Israel's Combat Helicopters." Defense Update International, volume 67 (1986). pp. 8-41.

Taylor, John W. R. "Combat Helicopters in Close-up: Havoc and Hokum." Jane's Defense Weekly, February 1986. pp. 152-153.

Volin, LTC V. "Helicopter Combat." Zarubezhnoye Voyennoye Obozreniye, number 12 (December 1984). pp.49-54.

Wickham, Gen. John A. jr. " The Challenges We Face." Army Aviation, May 1986, pp. 2-58.

Wyss, Dieter. "Helicopter Armament Today and in the Future." Armada, September/October 1984. pp. 115-116.

"Combat Helicopters Emerge as a Major Battlefield System." Jane's Defense Weekly, 6 April 1985. pp. 583-584.

"Marine Corps Aviation." Defense Update International, volume 63 (1985). pp. 28-36.

"Soviet Helicopters Update," Air Defense Artillery, Summer 1986. pp. 58-59.

"The Worlds Military Helicopter Fleet and It's Predicted Growth to 1990," Interavia, volume 34, (1979). pp. 688.

NEWSPAPER and LETTERS

"Army Studies Air to Air Helicopter Combat." Army Times, August 18, 1986. pp. 10-28.

Ostovich, BG Rudolph, III. Memorandum for Record while BG Ostovich was Assistant Commandant of the Center for Army Aviation. 4 November 1985.

Vuono, Gen Carl E. Letter to LTG Gerald Bartlett, Commander United States Army Combined Arms Center. August 1986.

Wickham, Gen John A., Jr. Letter to Gen William R. Richardson, Commander U.S. Army Training and Doctrine Command. June 1985.