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11 MAY 1979

AIR TO AIR HELICOPTER COMBAT
(USMC HELICOPTERS VS RUSSIAN HIND)

by

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USAWC MILITARY STUDIES PROGRAM PAPER

AIR TO AIR HELICOPTER COMBAT
(USMC HELICOPTERS VS RUSSIAN HIND)

INDIVIDUAL STUDY PROJECT

by

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PREFACE

The author elected to participate based on his prior experience and a genuine interest in the subject. An attempt was made to look at the full environment of helicopter air to air combat rather than just focusing in on the flight maneuvers.

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CHAPTER I

INTRODUCTION AND BACKGROUND

INTRODUCTION

> Helicopter versus helicopter combat is inevitable. It's inevitable because helicopters are armed and will encounter each other. In fact, the first helicopter air-to-air kill is history. In 1972, a North Vietnamese AN-2 trying to bomb a place in Laos was intercepted and shot down by an Air American UH-1 Huey. The people who say "That isn't our (your) mission" can be a problem. What they don't think about is that the mission can be thrust on you by the enemy: we can control our missions only in peacetime.[1]

The Soviets possess a formidable new threat with the HIND armed helicopter and it is capable of performing an air to air role against other helicopters in any future conflict. Our possible NATO flank role would put the Marine Corps up against the HIND and any country supplied with Soviet arms could theoretically possess this aircraft. Therefore, some published counter tactics are necessary.

Since little helicopter air to air combat has actually occurred and the potential is definitely possible today, this is an important but completely embryonic area of warfare. Very little information is available on the subject at this time. Until now the only "air to air" threat a helicopter pilot had to worry about was from a fixed wing. Although of definite concern, if the fixed wing was seen in time the helicopter could use "established tactics" (covered in a later section) and had a high probability of survival. Normally the fixed wing will not spend too much time on the helicopter (a few

passes). The HIND, on the other hand, lives in the helicopter realm of flight. It is fast and maneuverable and can hold firing parameters on another helicopter much longer than a fixed wing. It is an excellent weapons platform and has pilots trained in air to air killing. This paper will draw from many sources and try to present a "cookbook" type of approach. It will provide background information and actions/tactics that should or should not be considered when a US Marine helicopter unit is deployed for combat operations where the enemy is known to possess Russian HIND helicopters. Recommendations for improvements in armament and other areas will also be made. In addition, future design possibilities will be explored.

US MARINE CORPS HELICOPTER DEVELOPMENT

In 1947 HMX-1 (Experimental Helicopter Squadron) was formed at Quantico, Virginia, with the Sikorsky HO3S. Then in January 1951 the first helicopter transport squadron was commissioned with HRS-1's and set sail for Korea seven months later. Korea was a good proving ground for combat tactics; and missions included troop lifts, resupply, medevacs and a large scale night combat mission.

After Korea more squadrons were commissioned and the HUS replaced the HRS-1. Also the HR2S was added for heavy lift. In April 1962 Marine Corps helicopters arrived in Vietnam and would stay there in combat for nine years. In 1964 the corps received the first turbine powered UH-1E followed by the CH-46 in 1965 and CH-53 in 1966. All of these helicopters also were immediately sent to combat and were tested under fire. Specific mission and support tactics were developed

under combat conditions. It is mostly these tactics along with some developed by the US Army that the Russians have copied.

The H-46 was used for troop transport, inserting reconnaissance teams, medical evacuations, light cargo lift, and large troop movement missions. Both the H-46 and H-53 were armed with side mounted machine guns. The UH-1E assumed the gunship role in Vietnam in 1966 to augment support from fixed wing air. It proved to be extremely effective for close ground troop support and the only good escort for the transport helicopters. Sections of UH-1E's provided excellent covering fire while the transport helicopters were making approaches and departures from zones and during the time the transport was actually in the landing zone. The UH-1E COBRA joined the battle in the late 1960's. Its smaller silhouette and increased firepower greatly augmented the UH-1E gunship missions. In 1971 the two engine COBRA with the 20mm cannon proved to be even more effective.

Tactics were also developed for airborne command and control of this armada of aircraft (fixed wing and helicopter). A tactical air commander airborne or TAC(A) was positioned in a UH-1E for most larger operations and he controlled fixed wing, attack COBRA helicopters, and the transport helicopters. On large operations this is absolutely necessary for efficiency.

The latest development in equipment is the recent delivery of the TOW missile equipped helicopter (AH-1T TOW). In the training area Marine helicopter pilots are now training in low level flight, night

goggle use, and fixed wing evasive tactics. Tactics in these areas are progressing well. However, in the helicopter air to air area the tactics are still being developed.

RUSSIAN HELICOPTER DEVELOPMENT

The First Soviet Helicopter

Apart from a few autogyros, no rotary-wing aircraft were produced in the Soviet Union until the post-war years. Then on December 12, 1947, the first helicopter design bureau was founded under the leadership of M. L. Mil. It was here that the first helicopter, the Mi-1 Hare, was designed. Less than a year later in October 1948, it is said to have made its maiden flight and three years later was shown to the world in the 1951 Tushino Air Show.

By the mid- to late-1950s, two different Mi-1 helicopter designs were operational in Frontal Aviation units. The small, lightly armed Mi-1 Hare has now been largely forgotten; but despite its technological limitations it performed well as a small liaison craft for nearly a decade.[2]

The Mi-2

The advent of turbine engines in American and French helicopters led to the demand for new designs incorporating this new technology. The first flight of the turbine-engined Mi-2 Hoplite took place in Poland on August 26, 1965.

While it would be unwise to be too critical of the Soviet practice of making proven equipment serve new purposes by "strapping on" new

technology, the idea of the Hoplite serving as an attack helicopter seems quite unlikely. It is more reasonable to assume that it would be used to transport squad-sized subunits at low altitude over surface obstacles, including nuclear contaminated zones. Polish marine-infantry units have, in fact, demonstrated the utility of the Mi-2 in landing airborne units on a coast in connection with amphibious maneuvers. With each of the five ground armies in the Group of Soviet Forces in East Germany (GSFG) being supported by a regiment of Mi-2 Hoplites, one can postulate the existence of approximately 150 helicopters each capable of transporting eight-ten GSFG infrantrymen. At least theoretically, that is enough tactical airlift support for between 1,000 and 1,500 soldiers armed only with automatic rifles and light machine guns. Configures as a medical evacuation helicopter, the Mi-2 can carry four wounded on stretchers, one medical corpsman and equipment.

The Tactical Transports: Armed

The first of the medium-sized helicopters to enter service with Frontal Aviation was the Mi-4 Hound.

The second of the new turbine-powered helicopter to appear in Frontal Aviation was another Mil product, the Mi-8 Hip C. Designed as a replacement for the weary Hound, the Hip quickly proliferated throughout the military during the 1960s and also entered Aeroflot service in great numbers. Capable of transporting at least three rifle squads, it provides considerable tactical airlift capability. Twenty of these helicopters could, for example, transport an airborne

battalion of approximately 550 men with light arms. Equipped with large rear clamshell doors, the Hip is said to be also able to transport small vehicles of approximately BRDM (BTR-40) or Uaz-69 bulk.

An East German military author points to the fact that the Mi-8 is proof that all capable general purpose helicopters can be armed. Automatic grenade launchers (up to 40mm) and a 12.7mm machine-gun with a range of 1,000-3,000 m for use against moving targets are claimed for the Hip. In an air assault role, however, the Hip would undoubtedly be equipped with four standard 16- or 32-shot 57mm unguided rocket pods. Our East German author even points to the possibility of unguided rockets or guided missiles on side-mounted out-riggers which are intended for use in an anti-tank role. Moreover, each window in the Hip's transport section is also equipped with a device which the infantryman can use to support his weapon to fire at ground targets from the air. Apart from its obvious ability to support assault operations, its practical size and fine performance make the Mi-8 an outstanding utility helicopter which is sure to find increasing utilization throughout the military forces of the Warsaw Pact.[3]

The Star of the Show

With more than 200 helicopters (Mi-2s, Mi-6s and Mi-8s) already present in GSFG 16th Air Army, the Soviets introduced the Mi-24 HIND into Frontal Aviation's inventory in 1974. The rapid deployment of this new helicopter soon resulted in two units, each of regimental strength, based at Stendal and Parchim airfields in East Germany. With at least 72 HINDS--possibly more, considering the Soviet affinity

for the principle of mass (a West German source credits GSFG with 180)--the presence of this aircraft in the forward area has added a new dimension to theater warfare.

In the cockpit of the Mi-24 HIND A the pilot and copilot/navigator sit next to each other with the weapon systems operator (quite certainly also an officer) making up the three-man crew. The cargo area can carry at least eight and perhaps as many as 14 fully armed troops. The speed of an operationally configured Mi-24 may be a matter for conjecture, but on July 18, 1975, a helicopter of this same type (known in the press as the A-10) set a speed record of 334.461 km/h with the woman pilot Galina Rostorgevova at the controls.

Two primary variants of the Mi-24 are now in service in the 16th Air Army. The newer HIND D mounts a large caliber four-barrel Gatling-type machine gun (referred to as a machine cannon in the East German Press), and all-weather sighting systems including infra-red and low light television. A lazer rangefinder is mounted on the left side of the HIND above the inside rocket-pod pylon. The HIND A disposes of a built-in 12.7mm machine gun in the nose with 250-300 rounds, and less sophisticated aiming devices. In other respects the two variants are basically similar in that they both mount four 32-shot 57mm unguided rocket pods (the possibility also exists that a different caliber unguided rocket may be used) and four Swatter anti-tank guided missile rails. The missile guidance system also allows utilization of air to ground missiles, and bombs (up to 250 kg) can be carried when required.

The range of the 57mm unguided rocket has been given as approximately 1,200 m, with the ability to penetrate 200mm of armour. The

Swatter missile complements the 57mm rockets, having a range of approximately 3,500 m and, more importantly, the ability to penetrate 500mm of armour.

Undoubtedly, the Kremlin's decisionmakers--with a lot of advice from Soviet military professionals in a proliferation of higher military schools--kept close track of the US helicopter tactics in Southeast Asia. It must be assumed that the heavily armed assault helicopter with a multi-role capability can better find its place within the framework of Soviet military art than could a pure gunship-type attack helicopter such as the American AH-1 COBRA. The Soviets have therefore created a ". . . powerful combat aircraft which can carry out a broad range of missions, including hitting enemy personnel and equipment on the battlefield and in the enemy rear," and other enemy helicopters in the air.

HIND BASIC TACTICS

The HIND is never employed individually--always in sections of two and where possible in flights of six. The HIND has been used for air to air training. The Russians use balloons as air to air targets for the HIND.

CHAPTER II

US MARINE CORPS BASIC HELICOPTER TACTICS

PHILOSOPHY

Enemy HINDS can expect to be found near the FEBA (there mainly in an anti-tank role) or around the peripheral areas of the FEBA in the modern battlefield. In the peripheral areas they play an air to ground and an air to air role. Any third world country supplied with Russian arms could also have HINDS and therefore an air to air capability against our helicopters.

Under current Marine Corps doctrine, the helicopter's mission is mainly to support the ground troops. The ground Marines and the fixed wing air are supposed to do the fighting. However, the attack helicopter squadrons (currently AH-1 COBRAS) do have a mission of offensive fighting while supporting ground forces and escorting transport helicopters. The first Marine Corps "TOW COBRA" was also just received for use against mobile ground targets.

In this paper I am not suggesting that the Marine Corps change the role of its transport helicopters or that it fly helicopters into the FEBA. However, I do say that the odds of meeting up with this HIND character are very real. He has trained for air to air combat and is ready. How ready are we?

Currently the only armament on our transport helicopters are machine guns out the sides. Our COBRAS are basically equipped air to ground and are presently "outgunned" by the HIND. (More discussion

will follow on this in Chapter III.) The transport helicopters are not equipped air to air and our few COBRAS are not very well equipped air to air. Our transport helicopters would have to play a basically defensive role in the air to air battle--in short first avoid being seen and second if seen use other supporting arms to draw attention or engage the HINDS while the "transport helicopter" is "beating feet" out of the area.

First, to avoid being detected, the same basic tactics which are used by helicopters against all high threat weapons apply and will work against enemy air (both fixed wing and HIND). These basic tactics are terrain masking by low altitude flight, the use of darkness by night operations, and the use of low ceilings and visibility. In this section each of these three basic tactics areas will be expanded upon to some degree. In the next section basic evasive tactics and basic tactics helicopter against fixed wing will be covered. Then in the section following helicopter tactics and use of escorts/supporting arms against the HIND will be addressed.

BASIC HIGH THREAT AVOIDANCE

Terrain Masking

Terrain flight is the employment of an aircraft in such a manner as to utilize terrain, vegetation, and manmade objects to enhance survival by degrading the enemy's ability to visually, optically, and electronically detect or locate the aircraft. It involves a constant awareness of the positions and capabilities of enemy weapons and

detection means in relation to the flight route and masking terrain. Terrain flight is flying close to the earth's surface using low-level, contour, or nap-of-the-earth (NOE) flight techniques to counter an enemy's capability to acquire, track, and engage the aircraft.

Terrain flying is the only effective technique to counter a high threat environment. When selecting terrain flight routes, detection avoidance and protective cover are the governing factors. Terrain flight route selection planning shall consider the following additional principles:[4]

1. Keep a terrain mass and/or vegetation between the enemy and the helicopter. Take advantage of masking provided by radar ground clutter.

2. In mountainous terrain, use the friendly side below the crest of the ridgeline.

3. In flat to rolling terrain use the lowest contours. Either ground or vegetation contours as appropriate.

4. Avoid avenues of approach which lead to enemy positions.

5. When paralleling a vegetated area, fly below the crest of the vegetation and close aboard.

6. Avoid built up areas.

7. Do not follow manmade linear features and avoid using manmade objects as checkpoints.

8. Use heavily vegetated areas as opposed to open terrain. Aircraft shadows are broken and lost in darker vegetation.

9. Avoid silhouetting the aircraft when crossing ridgelines.

10. Know the terrain. Use recent photographic maps whenever possible.

In addition the planner must evaluate prospective helicopter landing zones (HLZs) and approach and retirement lanes for terrain flying compatibility. HLZs should be easy to identify from low altitudes and should provide cover and concealment for helicopters. Avoidance of detection and enemy fire should be two of the governing criteria for HLZ and lane selection. HLZ selection should be based on the concept of landing just beyond the enemy's detection and weapons' engagement range, then maneuver to attack. HLZs should be at locations which the enemy cannot defend.

Approach and retirement lanes should be based on control points which can be easily identified from low altitudes to facilitate enroute navigation. They should be wide enough to permit evasive action and accommodate the meandering flight routes used in terrain flying. They should conform to the terrain to take advantage of terrain masking, rather than be linear in shape and based on direct routing. Alternate routes must be selected based on the threat. Will the postulated threat that could close the primary lane affect the alternate lane? Do the routes unduly channelize the flow of traffic and render it predictable?

High Threat Environment Departures. Terrain flight techniques are used to execute tactical departures in a high threat environment. After takeoff, a rapid transition is made to either low-level, contour, or NOE flight for departure from the landing zone. Specific recommendations as to the execution of these departures cannot be made due to

the variables in threat and terrain which can be encountered. As a general rule, both the approach and the departure methods employed should be based on the same concept of avoiding the threat. That is, if a contour flight approach was required to reduce vulnerability, then a contour flight departure should be employed. The primary aims of the method employed are to avoid enemy detection and to make optimum use of the terrain for cover and concealment. It must be remembered that use of these methods requires extensive preflight planning.

Command and Control Considerations

The helicopterborne unit commander will no longer be able to use a command and control aircraft to supervise and control the activities of several units simultaneously from altitude. Rather, he will have to use the aircraft as a means of mobility between his units or possibly delegate the final decisionmaking authority to the helicopter unit commander. To ensure the success of the mission, the helicopter unit commander should have extensive knowledge of the helicopterborne commands concept of operation.

Tactical Air Coordinator (Airborne) (TAC(A)) is an experienced aviator airborne in the area of operations in a helicopter or fixed-wing aircraft. His primary responsbility is to coordinate and direct the activities of aircraft assigned to him and to report to the appropriate ground and air control agencies in his area of responsibility.

Normally, the high performance jet is not as effective for use in the TAC(A) role as slower aircraft due to performance characteristics.

The high performance aircraft's advantage lies in its ability to survive in a high threat area due to speed and ECM equipment, its compatibility with high performance strike aircraft, and its air-refueling capability. A slow mover's advantage, as the term implies, lies in the ability to move over the area at a relatively slow rate of speed, providing the TAC(A) better maneuverability and observation. If a TAC(A) is used it might be advantageous to have the high performance jet version not only for his own survivability but also to scare off any lurking HINDS and provide a limited ECM capability. In many possible battlefields "no communication" will be necessary. This will make pre-engagement supporting arms (both airborne escorts and ground) extremely difficult to coordinate. Once the friendly helicopter has actually been jumped (by either enemy fixed wing or HINDS) then communications will have to be used but then it is too late for much coordination.

Darkness for Concealment

Night helicopterborne operations offer a means of achieving tactical surprise, of improving detection avoidance, and of countering weapons which rely on visual target acquisition. However, achievement of these results in a high threat environment continues to depend on the effective use of terrain masking to avoid detection. The proliferation of sophisticated air defense systems for detection and target acquisition and the widespread introduction of night vision/sighting devices negate part of the tactical advantage gained from the concealment afforded by darkness for flights at altitudes above the terrain

mask. Visual acquisition is definitely more difficult at night but the HIND does have FLIR and low light TV. Marine helicopters could definitely use some improvements in the night vision devices area.

Before selecting a night flight route, obtain information which identifies the enemy's air defense capabilities. The air defense threat will dictate the type of flight (low-level, contour, or NOE) to avoid detection by the enemy. A safe altitude will vary with the type of terrain and the distance of weaponry from the aircraft and can be determined by conducting a terrain profile. The helicopter can then be flown at the highest altitude which assures safety as it passes from the rear area forward to the forward edge of the battle area. This procedure relieves the pilot of the stress and fatigue that he would experience if he flew the entire route NOE.

To ensure that the flight route will be planned to avoid known enemy air defense artillery positions, plot them on the map. Identify enemy ground forces and, when possible, avoid overflying them. Consider also the enemy threat in the landing zone. Intelligence reports may indicate a sufficient number of profitable targets in and around the landing zone; however, the effect gained by an artillery preparation may not offset the loss of surprise. Artillery preparations are normally omitted from night helicopterborne assaults, but are preplanned for on-call use on and around the landing zone. Smoke can be used effectively at night and its use should be considered.

Before conducting a terrain flight at night over enemy positions, aircrews should be advised of the enemy's passive defensive capabilities.

To ensure a terrain mask for helicopters, select a route on which higher terrain lies between the route and the known enemy position. Mask the helicopter from both electronic and optical weaponry. When terrain or the location of enemy weapons restricts masking from both systems simultaneously, mask the helicopter from the electronic system. This situation occurs when the enemy's optical weapons are strategically located to fill gaps where his radar cannot detect low-flying aircraft. Visual detection at night is difficult for optical guncrews, even when the helicopter is not masked; but electronic detection is not affected by conditions at night.

Special Night Vision Devices

During the initial planning phase of a night operation, identify requirements for special equipment. Based upon mission and ambient light conditions, one or more of the following special items may be required for night terrain flight:

1. Helicopter with special night configuration device.
2. Night vision goggles.
3. Special night map.

If the helicopter itself is not configured with a special night device, the night vision goggles offer excellent possibilities and should be considered for night terrain flight. The use of the night vision goggles for night terrain flight requires pilot experience and excellent crew coordination. Some ambient light is also necessary for the goggles to work properly.

The decision to conduct night terrain flight should be based on existing and forecast meteorological conditions. These conditions must be considered in the planning phase to determine their effect on the night operation.

Although forecast weather conditions do not always materialize, the risk of encountering adverse conditions during the mission precludes terrain flight at night into forecast IMC.

Existing weather conditions allow an immediate evaluation of the effects upon ambient light. With a cloud cover (overcast), hemispherical illumination may be reduced to total darkness. Operations may be conducted during conditions less than overcast; however, the use of night vision devices will decrease the risk. Missions should be conducted with the unaided eye under these conditions when the moon is at its zenith. Restrictions to visibility (e.g., fog, haze, smoke) are the most serious of the meteorological conditions experienced at night, since both the unaided eye and night vision devices are affected.

Low Ceilings and Visibility

Low ceiling and reduced visibility can be assets when flying in a high threat environment. There will be less enemy aircraft in the air (both fixed wing and helicopters). The enemy's optically and visually guided antiaircraft weapons will be less effective and may even be neutralized. An infrared seeking missile's effectiveness will probably also be reduced, because the enemy must acquire the target optically. In reduced visibility, no one can pinpoint the location of a helicopter or judge a heading or distance by sound. A low ceiling

may be an asset in an operating area in which friendly forces have at best only air parity, since enemy aircraft are forced to work above IMC and have a reduced capability to locate and attack helicopters using terrain flight techniques.

Such assets, combined with the need to conduct a critical mission, may make it advantageous to conduct terrain flight in adverse weather. Visibility is the primary limiting factor and will determine whether the flight can be conducted successfully. Terrain flight is most difficult and extremely hazardous when conducted in ground fog. It can be conducted when there is sufficient visibility for accurate navigation and avoiding obstacles. Adequate visibility is required at the takeoff point, en route, and in the objective area. Sufficient visibility is required over water to provide a visible horizon. During the conduct of the flight, the most important considerations are maintaining both visual reference with the terrain and a slow enough airspeed to avoid obstacles.

Missions conducted in adverse weather should consist of as few helicopters as possible. A single aircraft or a section of two aircraft can operate under worse conditions than a large flight. Multihelicopter operations require sufficient visibility and ceiling to permit "see and avoid" air traffic separation and to minimize inadvertent entry into IMC. An airborne weather reconnaissance flight should be conducted to determine existing weather conditions before a multihelicopter operation is executed in adverse weather.

Proper Perspective

A very strong case has now been advocated for flying around at low altitude, at night, and in bad weather to minimize dangers of a high threat environment. It must also be pointed out that this is an extremely demanding and dangerous type of flying. This type of flying should only be done when necessary, in a professional manner, and with strict adherence to established procedures. It should be remembered that of the Marine Corps helicopters lost in the Vietnam War a large percentage were not due to actual combat and many just ran into mountains at night or in bad weather. The HIND may be a formidable threat but he will not be lurking behind every tree on the battlefield, and it is better to die fighting than by running into a mountain at night or in bad weather.

BASICS FOR SURVIVAL IN AIR COMBAT

Regardless of the type of helicopter flown or the tactic used, there are five basics for survival in contested airspace:

1. Seeing the enemy aircraft first.
2. Recognizing the enemy aircraft.
3. Avoiding detection.
4. Anticipate the aggressors attack profile/scheme.
5. Taking evasive action.

Seeing the Enemy Aircraft First. This factor has long been established as an element of survival in any combat situation. The advantages in seeing the enemy first are in large measure self-evident

and their importance cannot be overemphasized. All aircrewmen, even passengers, must be thoroughly aware of their responsibilities in this area. If significant enemy air activity has taken place or is expected, some aircrewmen may be assigned the task of watching for enemy aircraft as their sole responsibility. The field of vision from some helicopters is extremely limited, particularly up and to the rear. This is a very dangerous area, since fighters prefer to attack from the rear or blind side if they are given the opportunity.

Fighters normally operate in pairs, but may be encountered in fours. They usually depart on and return from missions in fours and are split up into two elements, so that one element can engage a target and the other stay loose (for four together, there will be two elements of two each; with only two, there will be two elements of one each). The loose element usually directs the attack of the engaging element. Whenever one fighter is acquired, it is prudent to continue the search for the other(s). Fighters are quite difficult to see because they fly at high speeds and, once acquired, are difficult to keep in sight.

It is noteworthy that most airborne radar are relatively ineffective for acquiring helicopters using terrain flight. Helicopters are slow moving targets and ground clutter considerably reduces the efficiency of airborne radar. It is not outside the technological capability of threat forces to develop a look-down shoot-down radar.

Monitoring of guard, tactical air-ground, and command nets may provide early warning of hostile air activity. Exhaust smoke and

glints from canopy surfaces and external stores are often seen before the aircraft itself is sighted. Friendly antiaircraft fire is a dead giveaway that hostile aircraft are present.

Recognition of Enemy Aircraft. Every aircraft sighted must be considered to be hostile until it can be positively identified. A knowledge of national markings is not enough. Aircrewmen must be thoroughly familiar with all of the types of helicopters and fixed wing aircraft employed in the combat zone. This familiarity should include the tactics of both friendly and enemy aircraft. Aircrewmen must be able to differentiate quickly between a nonaggressive maneuver and a maneuver for attack, as this will be the first clue in determining whether or not the helicopter has been detected. Aircrewmen must also develop the capability during training to recognize aircraft at maximum range and at various angles and altitudes. Binoculars may aid in early detection and identification and so enable the helicopter pilot to take timely action to avoid acquisition or engagement.

Avoiding Detection. What is not seen will rarely be hit. Helicopter crews must be thoroughly familiar with the principles for avoiding detection and must put them into practice during mission planning and training until they have become second nature to them.

Heading. Avoid flying in a straight line for extended periods, particularly down valleys, which make good avenues of approach for high speed aircraft. Valley floors are often devoid of dense vegetation and hill masses, which makes the helicopter relatively easy to detect. It is preferable to fly below ridge lines and when possible to use the

reverse slope. Varying heading frequently decreases the helicopter's susceptibility to detection and, in the event of an undetected enemy aircraft attack, can very well save the helicopter.

Airspeed. The varied airspeeds flown during terrain flight also reduce an enemy aircraft's ability to detect the helicopter. Nap-of-the-earth (NOE) flight using lower airspeeds will significantly degrade the enemy's ability to detect the helicopter. However, NOE flight can contribute to detection should rotor wash cause tree limbs, leaves, dust, snow, sand, and debris to blow, and so make the helicopter's signature recognizable from the air. Surface conditions are an important consideration when in NOE flight or operating at other terrain flight altitudes.

Altitude. An extremely important consideration in selecting flight altitude is that the lower aircraft may have the advantage of acquiring the higher aircraft first. This gives the lower aircraft the initative in choosing a course of action to avoid detection. In terrain flight, aircraft tend to blend with the background, while aircraft flying at altitude are silhouetted against the sky.

Maneuvers. Violent aircraft maneuvers are usually counter-productive as a means of avoiding the aircraft. Erratic movement is more likely to attract the eye and cause a magnification in the glare and glint from the windscreen and rotor. Violent maneuvers also significantly increase the likelihood of striking an object and losing control, which just as quickly and permanently results in a catastrophe, as being hit by the enemy.

Silhouette. Pilots must be constantly alert to the aircraft's position relative to the horizon ("sky lining"). Any time that the helicopter is silhouetted against the sky, it is relatively easy to acquire. Also, the position of the sun and the type of terrain may silhouette the helicopter. For example, a helicopter that is painted a dark color should avoid overflying a sandy area.

Shadow. An enemy pilot may often see the shadow cast by a helicopter before he sees the helicopter. A shadow on an open field with little vegetation is much easier to see than a shadow cast in a forest or broken terrain. Shadow size and resolution are relative to altitude and the position of terrain. Terrain flight minimizes shadow size. Remember that a shadow is there and that it can give the helicopter away. Though difficult, there are ways to eliminate or camouflage an aircraft's shadow. Try to keep the shadow of the helicopter in the shadow of the clouds, in terrain features, or in weed lines. Shadows will cause considerable difficulty in desert combat, but over most other terrains, they can be partially hidden or diffused by selecting flight routes and positions with reference to the sun's position.

Camouflage. Camouflage patterns and colors on helicopters are particularly effective at altitudes less than 1,000 meters. Rotor blades should not be camouflage painted. What may be an excellent pattern when the rotor is at rest may create a barberpole effect when the rotor turns at operating speed. All portions of the helicopter's moving parts, including blades, head, swash plate, and control tubes, should be painted with low IR paint. Cargo doors should be closed

during flight to prevent reflections from floors or the shiny surfaces of objects carried internally.

Reflection. Reflection from glass surfaces is reduced if the helicopter is kept between the enemy aircraft and the sun. When hovering, parked, or flying, use shadows to reduce glints.

Night. When operating a helicopter on a moonlit night, consider the possibilities of silhouetting against the moon or clouds.[5]

TACTICS AGAINST FIXED WING ATTACK

A pilot can never know when or if his helicopter has been acquired by an enemy aircraft. An enemy pilot may have acquired the helicopter, but elected not to engage because of a higher priority mission. Perhaps because of the presence of friendly fighters, or the threat posed by local air defense weapons, the enemy pilot may consider an attack on the helicopter not worth the risk.

One of the most critical decisions that a helicopter pilot must make is whether to rely on avoiding detection or to initiate evasive action. There are some indicators of when a fighter is about to attack. If the fighter begins to circle, fly toward the helicopter, or make a sudden climb to get into attack position, then the helicopter pilot should assume that he has been detected and will be attacked. It is then time for him to initiate evasive action. In any event, whenever in doubt as to an enemy fighter's intentions, begin evasive action.

Range and altitude will also determine if the enemy fighter is in position to attack. If not in position, the enemy fighter must execute a turning and/or climbing maneuver. The turning radius of modern jet

fighters is quite large. The fighter pilot will usually lose sight of the helicopter during the turn and will only be able to orient his attack on a terrain location, where he last had visual contact with the helicopter. The fighter pilot will initiate the firing pass and attempt to reacquire the helicopter, normally about halfway down the attack run. If the helicopter has moved to another concealed location, even as much as 100 meters from the previous location, it may have made it impossible for the fighter to engage on the initial firing pass after he reacquires the helicopter. The fighter pilot must then go through the entire process again. When fighters are working in pairs or coordinating, their effectiveness will increase even if the initial attack is unsuccessful.

Fighter aircraft are armed with fixed, forward-firing weapons which require the fighter to line up on the target under attack. After the fighter pilot is lined up on the target, he must allow the gyro-stabilized sight one to three seconds to stabilize. He must then track steady to achieve a well-aimed shot. If the helicopter pilot can deny him this opportunity, the chances of survival increase considerably. However, just because the helicopter is concealed does not mean that the enemy fighter can't hit it if the pilot knows where it is. Tree bursts and ricochets from exploding projectiles can be just as fatal as a direct hit.

The recommended tactic for a helicopter pilot under fighter attack is to fly directly toward the attacking fighter to cause the fighter pilot to deepen the dive and increase airspeed. Just before anticipated engagement, make a sharp turn either right or left but in the direction

from which the helicopter pilot will best be able to keep the fighter in sight. Should the fighter stay on the helicopter in the turn, another sharp turn in the opposite direction should end in disengagement. If the maneuvers are timed and executed properly, the fighter pilot should not be able to stay with the helicopter and bring his weapons to bear. The direction of the helicopter's initial turn depends on many variables, including terrain, obstacles, available cover or concealment, position relative to the attacker, and the probable direction of succeeding attacks.

Fighters attack from altitude to gain more time to line up the target in the sights. The steeper the dive angle, the greater the accuracy achieved by fixed, forward-firing weapons. A fighter pilot can get into serious difficulty in a steep, high speed dive when he gets close to the ground. If pullout is not executed properly, the downward momentum (sink rate) from the dive may force the fighter into the ground. Mountainous, rugged terrain will normally force a fighter to make steep diving attacks. If the direction of the helicopter's evasive turn induces the fighter pilot to maintain his attack too long, the fighter may impact with the ground.

Friendly fighters can always help. Immediately call for help and attempt to lure enemy fighters toward friendly elements which can assist. It is vital to know the locations and radio frequencies of air defense units in the operational area. Coordinate with forward air controllers to determine how to receive assistance rapidly from nearby friendly fighters. Nearby tactical units can also be of assistance with their

supporting air defense weapons. This coordination should always be a part of pre-mission planning.

Formations of helicopters are easier for enemy fighter pilots to acquire and attack. Avoid tight geometric formations because they prohibit effective evasive action when the formation is attacked by surprise. Trail formations may provide a fighter pilot with an opportunity to hit all helicopters in one pass. Loose, staggered, or free trail formations are probably the best formations to use.

The use of smaller rather than larger formations is preferable when fighter aircraft are the greatest threat in the operational area. Consideration of the type of formation to use will depend on the threat, degree of control required, and tactical requirements. Regardless of what formation is used, when fighters are the threat, aircrews must be thoroughly briefed on what to do when attacked by a fighter. The briefings should stress the responsibility of looking for enemy aircraft. When flying in a formation, aircrews may be lulled into a false sense of security due to "strength in numbers" or "the other guy is watching for them" attitudes. Flying in a formation also diverts the pilot's attention because of the demands placed on him to maintain relative position in the formation and, when in terrain flight, to avoid obstacles. Briefings must include formation break-up procedures, rendezvous points, and mission contingency if the formation is attacked by fighters.[6]

The most vulnerable point of a mission for a large formation of helicopters is to be caught by fighters while on short final approach

to a landing zone, because not only have the helicopters lost the ability to maneuver, but rockets and bombs will also be effective against the entire formation. It is essential that large helicopterborne operations, which are conducted in areas where enemy fighters present a threat have friendly fighter protection and that the first echelons landed have sections which will provide landing zone air defense protection.

For evasive actions to be executed successfully, excellent team work is required from the members of the aircrew. The pilot must devote his attention to operating the helicopter, especially in terrain flight, and must rely on accurate, timely information from the aircrew about all the activity that he cannot see for himself. Most fighters begin firing from 1,500 to 1,000 meters out. The greater the range at which an enemy fighter is spotted, the better the chance the helicopter pilot has to plan and execute timely evasive maneuvers. Timing of evasive action is of critical importance. Evading too early may not prevent the attack; taking action too late will be fatal.

It should not be overlooked that helicopters might be able to take some offensive actions against the fixed wing during the maneuvering. For this they must have the correct weapons. CH-53 and AH-1 helicopters are capable of converting to an air to air missile (SIDEWINDER OR STINGER) launch zone rapidly, especially if they begin to turn just prior to crossing during a head on pass. Both helicopters can obtain 0-30 degrees off the tail at 3000 feet range as the fixed wing aircraft pulls off. The pull-up silhouettes the fixed wing against blue sky, an excellent

background for IR missile discrimination. This fact is worth remembering when possible helicopter armament solutions are discussed in Section III. Just the fact that the helicopter has some air to air capability will make the enemy stand off to some degree.

CHAPTER III

US MARINE CORPS HELICOPTER TACTICS AGAINST THE HIND

The Marine Corps inventory has two basic types of helicopters; the transport consisting of CH-53's, CH-46's, and UH-1N's, and the attack helicopters consisting of the COBRA gunships (AH-1's, AH-1T's, and AH-1T TOW's). Since once of the main missions of the attack helicopters is to escort and protect the transport helicopters, the tactics of the attack helicopter against the HIND will be considered first.

MARINE CORPS ATTACK HELICOPTERS AGAINST THE HIND

When looking at one attack helicopter versus another three areas are extremely important. These three areas are helicopter capability (both flight parameters and armament), pilot capability (training and experience), and mass (numbers and ability to attack using good section tactics). Keeping these three areas in mind the capability of the COBRA versus the HIND will now be analyzed.

Simulator Experience

Before simulators are used certain limiting assumptions must be made. In the case of helicopter combat simulation done so far the assumptions are limiting and therefore the results of the simulation become subject to question. However, it is a place to start.

The COBRA and HIND seem reasonably matched in flight parameters. The COBRA has a tighter radius of turn, but the HIND is faster and

carries more weight. If a one helicopter against one helicopter duel is assumed and the COBRA and HIND had equal armament (which they do not), the pilot with more experience will win most of the time. However, the pilot learning curve is fairly rapid (if he stays alive). This is simply the old case of locking two out of three variables and the side with the edge in the only remaining variable wins. It is interesting to note that if the pilots have basically equal experience they both shoot each other down 40 percent of the time on the first pass. Fix all the variables and that is the result. But if the HIND is given a gun with a higher rate of fire, higher velocity, and a better sighting system (which is the true case with the HIND), the outcome changes. Even if the COBRA has a better pilot the HIND can engage the fight outside the COBRA range and usually win. The HIND simply has the COBRA "outgunned." If the HIND has an air to air missile the situation becomes much worse.

Mass

Since simulation currently only allows a one-on-one situation there is no empirical data to support the following conjectures. However, basic logic will probably support them. If more COBRAS are introduced there will obviously be a point where a single HIND will be shot down even if he can "outgun" the COBRAS. But it is probable that at least one COBRA will be lost. The HIND never travels alone, so you can depend on at least a section of HINDS. As the progression is made into fights of a section or sections of HINDS against a section or sections of COBRAS, the actual flight experience and section tactics become more important and the outcome harder to predict. But

one fact remains clear, the better armament on the HIND gives it a definite advantage. Also with only one Marine attack helicopter squadron per air wing, which also must support the ground troops, the luxury of having enough COBRAS to sufficiently mass against the HIND in any European war will seldom exist. The situation might be different if fighting a third world country which only possessed a few HINDS.

So here is a case where the attack helicopter, whose mission is to escort and protect the transport helicopters, would be at a disadvantage if it became engaged in air to air combat with the HIND.

Possible Immediate Armament and Design Improvements

It was mentioned earlier that the COBRA would be at a basic disadvantage if it became engaged in air to air combat with the HIND (D model) because the HIND D has it outgunned. So one of three things must be done to accomplish the mission (i.e. killing HIND D's and protecting transport helicopters). The three choices are (1) acquire more COBRAS to increase mass (but also more COBRAS will be lost), (2) improve COBRA armament so it is not "outgunned," or (3) give another supporting arm the mission of killing HINDS and escorting transport helicopters.

The problems with choice (1) are self evident. Choice (3) will be explored in the next section when the tactics of the transport helicopters versus the HIND will be examined.

Choice (2) could be accomplished if a gun with a higher rate of fire and ammunition with more energy (distance and hitting power) were

installed along with better sights and some air to air missiles. Also tracers should be more frequent and brighter than with the current ammunition.

MARINE CORPS TRANSPORT HELICOPTERS VERSUS THE HIND

Since this is essentially a case of unarmed helicopters versus armed helicopters, one of the best solutions is to avoid the confrontation by not being seen as was discussed earlier. However, nondetection cannot always be depended upon and additional planning considerations are definitely necessary if the transport pilots want to continue having birthdays. There are four main areas to be considered. These are the areas of flight planning for the specific mission, supporting arms (attack helicopter or fixed wing air escort and/or ground supporting arms), actual air to air flight tactics, and possible immediate armament and design improvements. Each of these areas will now be expanded upon.

Flight Planning and Loading

Flight planning to include route selection, crew and escort briefing, payload weight, and aircraft configuration are more critical in a high threat environment. If enemy air to air capable helicopters are included in the threat, then some additional considerations are necessary.

Low level flight requires more power margin for maneuverability so the transport helicopter should only be loaded to a percentage of its maximum possible payload. External loads require less time in the zone and may be released if the helicopter must have maximum power margin and maneuverability to escape or perform air to air combat.

However if a HIND just forces a transport helicopter to drop its load then the HIND's mission was at least in part accomplished. External loads have some drawbacks. A helicopter is much slower and less maneuverable with an external load, and development is necessary to make slings that are shorter and more stable for low level flight.

Even though each case requires separate consideration the advantage of external loads probably outweigh the disadvantages.

Crew and Escort Briefing

When enemy air is present (either fixed wing or helicopter), a crew member other than a pilot will almost always see the enemy aircraft first. It is extremely important that all crew members attend briefings and that all facets of crew coordination are covered and clearly understood.

If there is an airborne escort all crews should have a combined face to face briefing whenever possible to include hypothetical actions and possible uses of supporting arms.

As a basic rule the flight should be planned to fly as near friendly supporting arms as possible and as far from enemy supporting arms as possible.

If a low level or night flight is to be conducted, procedures outlined in the assault helicopter tactics manual should be followed.

If a large flight (section plus) is to be conducted and a TAC(A) is required, consideration should be given to a fixed wing attack aircraft for this role so it could also provide air cover against the HIND.

Escort and Supporting Arms

Escort

The COBRA attack gunship proved to be the best possible escort for transport helicopters in Vietnam. It would still be the best possible escort if it were not currently outgunned by the HIND. Therefore, for the COBRA to do the job well it would need a gun with a higher rate of fire and better ammunition and sighting as previously outlined. If the HIND acquires air to air missiles then the COBRA would also need a couple of these to perform the escort mission.

Although fixed wing attack aircraft cannot truly "escort" transport helicopters (because of their speed), they can provide protection. However this is only true if they are dedicated for the mission, airborne, and know where the helicopter is at all times. If all the above stipulations are not met, the fixed wing attack aircraft is worthless because the HIND has killed the unarmed helicopter before the fixed wing "finds the battle." The Harrier AV-8 appears to be a good fixed wing for this mission but definitely not the only one. It can deploy to forward bases, it has a weapons array appropriate for the mission, and it has the thrust to weight/acceleration necessary for successful extension maneuvering.[7] The 30mm gun system is an excellent weapon but another excellent fixed wing attack weapon against a low flying helicopter is the MK-82 bomb because of the area coverage. The biggest problem with the fixed wing covering the transport helicopters is that there will probably never be enough available for the mission, and this is not the kind of mission where a hot pad aircraft will help. A hot pad aircraft would just be too late.

Supporting Arms

It was previously mentioned that it is desirable to fly in areas where friendly supporting arms are available and the enemies' are not available. It is also important to realize that friendly supporting arms will be of the most assistance before any actual aerial engagement begins (even if it is just a chase). Once the engagement begins it is difficult to hit the "bad guys" without hitting the "good guys."

The three main types of ground supporting arms are guns, ground to air missiles, and artillery. A good heavy gun system is probably the best ground supporting arm against the HIND. The problem is getting a clear shot against the low flying HIND. As was demonstrated in Vietnam, small arms if coordinated in mass can also be effective against air.

In the ground to air missiles the heat seekers (such as the Redeye) can be very effective against enemy air. However, there are some problems when employed against low flying enemy helicopters such as the HIND. It is hard to get a clear shot, there is a lot of terrain background clutter, and if there are friendly aircraft in the area (even if not engaged) the missile may like a friendly tail pipe better than an enemy tail pipe. The newer "TOW" wired-guided missile is primarily a ground to ground and air to ground antitank missile but could be effective against enemy helicopters under specific conditions. If the HIND stays in a hover then the TOW has a chance of a kill. However, the TOW cannot follow movement much faster than a tank so normally it would only be useful for distracting the HIND or possibly scaring him off.

Pre-positioned artillery fires can be very useful if the friendly helicopter knows exactly where they are located (difficult when flying low level). Even if they do not hit the HIND they may be useful in distracting him or scaring him off. Considering the use of artillery for anything more than pre-positioned fires against the HIND is really wishful thinking.

It is readily apparent in the case of all three types of supporting arms that pre-mission coordination planning and establishing supporting arms communications is absolutely essential to any success. This has been clearly demonstrated by the years of live fire combined arms exercises at Twentynine Palms. The preflight coordination becomes even more important and more difficult when the battle situation dictates a "no communications" environment.

Possible Immediate Armament and Design Improvements

Given that there is no need or desire to alter the mission of the transport helicopter, design and armament changes will be considered only from a survivability point of view.

Design

These must be changes that can be accomplished without major changes to the air frame. Any design change that makes the helicopter harder to see or find is an advantage. These include low IR paint, low IR rotor blades, non-glint cockpit windows, and others. These types of changes are relatively inexpensive and they help not only against detection by the HIND but also against all enemy weapons on the high threat battlefield.

Armament

Several possible armament changes have been hypothesized. The advantages and disadvantages will now be examined.

A forward firing gun would add weight to the cockpit area and a transport having a gun dual with a HIND is not tactically very sound. The transport is less maneuverable, especially when loaded, has less visibility, and would be departing from its missions. A ramp mounted, rear firing gun at first appears to have some definite advantages. It could be used to hold the HIND at a distance while the transport heads back to friendly territory. It would have a reasonably good field of fire because of higher speed the transport is in a nose low and tail high configuration. Cranking off a string of 30mm tracers would help keep a HIND (at least one without air to air missiles) at a safe distance. The big disadvantage is that the gun would block the main loading area of the transport helicopters.

The Redeye missile is light and transportable. It has been suggested that the transport could land and the Redeye team jump out and fire the heat seeking missile at the HIND. (The missile cannot be fired inside the transport because of the backblast.) This is not a viable solution because the transport is vulnerable while landing and the Redeye must be carried partially disassembled when transported by helicopter. It would have to be assembled on the ground prior to firing.

The Russians have provided for their troops to fire out the sides of their Hip helicopters. This may well be one area where their lack of helicopter combat experience surfaces. It is definitely possible

that troops inside a friendly helicopter could shoot more parts off the friendly helicopters than off the enemy helicopters.

Another possibility is to mount a couple of air to air missiles on the transport helicopter. This has the advantage of letting the HIND know that if he plays around with the transport he could be bitten back. The transport would no longer be an unarmed helicopter. The HIND could have the best gun in the world and he would think twice before attacking that missile. Another major advantage is that then the transport would probably not require an escort. The friendly attack helicopters and fixed wing could concentrate on their other missions. Another consideration is that this would provide a minor offensive capability against enemy fixed wing. As was mentioned in the evasive maneuvers sections transport helicopters occasionally obtain missile firing parameters on enemy fixed wing. In short all enemy air would be much more hesitant to tangle with the transport helicopter. Disadvantages are in the areas of cost and weight. However, if the system and rails were installed on the helicopters, the missiles themselves would not be required unless the helicopters were deployed to a theater of combat where HINDS were actively employed.

It is highly probable the HIND will attach an air to air missile in the near future. In this age of precision guided ordinance, if both sides have air to air missiles the probability of either getting a kill without being killed in return is low (assuming at least two helicopters per flight on each side). This would probably cause the HIND to stick to his air to ground mission. However, if the HIND had air to air

missiles and the friendly helicopters did not, the probability of a kill for the HIND would be extremely high. The HIND would then spend a lot of time "looking for helicopters."

Once again it should be emphasized that there should be no change in mission for the transport helicopters. They can go about their transport mission much more efficiently if not bothered by HINDS, not requiring escorts as often, not being attacked by enemy fixed wing as frequently, and not requiring complicated supporting arms procedures. Two air to air missiles (modified Stingers or like missiles) would without a doubt be the best solution to the transport helicopter armament problem.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Considering the probable Marine Corps NATO flank mission and the number of countries worldwide that possess Soviet weapons the possibility of encountering the Russian HIND becomes a reality. The Marine Corps relies heavily on its transport helicopters both for mobility and supplies.

It appears that the greatest threat to transport (essentially unarmed) helicopters is the HIND. The HIND is much more mobile and maneuverable than the ZUS-23 and other high threat weapons. The HIND will not necessarily stay close to the FEBA or main enemy positions. Unlike fixed wing aircraft the HIND lives in the helicopter flight environment and can maintain firing parameters on other helicopters for much longer periods of time than the fixed wing. Clutter from terrain flight background or flares will usually distract portable ground fired SAM-7 missiles and the STRAGGER cannot track a target moving much faster than a tank. However, a transport helicopter with a HIND on its tail is a "dead duck."

At the beginning it was stated that this paper would present a "cookbook" or "checklist" of actions to be taken if a Marine helicopter unit were deployed to combat where the enemy employs HIND helicopters. The checklist has been formulated as this paper has progressed. First, methods to avoid detection were discussed. Next, evasion tactics in

general and evasion tactics against fixed wing were discussed. Then flight planning and escort methods were considered. At present there are definite problems because an escort is needed. The other means for avoidance/protection, although helpful, probably do not provide enough security. Currently there are no where near enough fixed wing to be dedicated escorts and the HIND outguns the COBRA attack helicopter. With the probability of the HIND adding an air to air missile the transport helicopters become even more vulnerable and the COBRA would need both a better gun and an air to air missile to provide adequate escort. The real problem is that there are just not enough fixed wing aircraft to dedicate to airborne escort/support of every transport helicopter flight. There are also not enough attack COBRAS for the escort mission because they are heavily involved in the ground support role. The TOW is not a good air to air missile because it cannot follow any target much faster than a tank. Therefore, future recommendations are required and will be stated after the checklist. The recommendations will be given after the checklist because the checklist is based on current capabilities.

CHECKLIST

Avoid Acquisition by the HIND

1. Use terrain masking.
2. Minimum use of radios.
3. Use darkness and special night vision devices.
4. Use low ceilings and visibilities.

Know Basic and Fixed Wing Evasive Tactics

5. Use basic air combat survival tactics.

6. Know fixed wing evasive tactics.

Flight Planning

7. Select route considering best use of supporting arms.

8. Plan less than maximum load--consider terrain flight and maneuverability.

9. Use short, stable slings for external loads.

10. Entire crew attend briefing and establish clear lookout procedures.

Escort Considerations

11. Use fixed wing escort/support aircraft--only on the condition they are dedicated to the mission and airborne.

12. Use COBRA escort and realize armament limitations. However, if armament has been improved to at least equal to HIND since this writing then COBRA escort is preferable to fixed wing.

13. All transport helicopter flights should be at least two aircraft.

Supporting Arms

14. Prior to flight conduct coordination for use of ground gun system, missile, and/or artillery supporting arms.

Air to Air Maneuvers

15. Know classified air to air combat maneuvers cold.

RECOMMENDATIONS

First, the three main recommendations resulting from this study will be made, then they will be expanded upon. The three main recommendations are as follows:

1. Perform necessary R&D and training to arm transport helicopters each with two air to air missiles for survival and if employed in a HIND environment attach the missiles.

2. Arm Marine Corps attack helicopters with a better gun system and some air to air missiles and increase the number of attack helicopter (COBRA) squadrons in the Marine Corps.

2.a. Alternate Solution--Buy the Army Advanced Assault Helicopter (AAH) and use them to augment current USMC attack helicopter assets. Incorporate an air to air missile on both types of attack helicopters.

3. Train fixed wing attack aircraft in "killing HIND helicopters."

Recommendation 1 Discussion--Mounting two air to air missiles (modified Stingers or like missiles) on each transport helicopter would be the best solution to the HIND threat problem. As was previously mentioned in armament recommendations, they can go about their normal transport mission not being bothered by HINDS, not requiring escorts as often (only for larger flights), not being attacked by enemy fixed wing as frequently, and not requiring complicated supporting arms procedures in no radio environments. If the HIND knows it stands to get bitten back if it attacks the transport it will probably stick to its ground support role.

Recommendation 2 Discussion--In this age of precision guided munitions (PGM's) the attack helicopter, with systems such as the TOW, becomes even more important as a ground support weapon. However, it will still be

needed to support other helicopter flights--one attack helicopter squadron per MAF is just not enough. An improved gun system is required that includes the following items--much higher rate of fire gun, higher energy ammunition (more distance and hitting power), better tracers, better sighting system (heads up display and lead computing). This improved gun system will also help considerably with ground targets. The air to air missiles should be of the modified Stinger variety and adaptable to existing racks so TOWS and air to air missiles may be carried concurrently. In short, an attack helicopter should at least have armament equal to if not better than its opponent.

Recommendation 2a Discussion--The new Army AAH already has the better gun system (30mm--high rate of fire), excellent target acquisition and night capability (TV, FLIR, telescopic optics, and laser rangefinder), and some hardening and redundancy (oval engine and flight controls). The Army has already paid for the development and will purchase over 500 to lower the cost per aircraft. Therefore, it might be cost effective to buy the AAH rather than modify the COBRAS. This would cause further specialization of missions--the existing COBRAS would mainly support the ground forces and escort the transports in a non-HIND environment and the AAH would support the ground forces and also escort the transport helicopters. This would equate to something like the Army's Hi-Lo mix. If the HIND does attach an air to air missile both types of attack helicopters would then also need to attach a couple of air to air missiles for survivability.

Recommendation 3 Discussion--For fixed wing to kill helicopters, especially ones that are heavily armed with trained pilots, it is not as easy as one might think. Major Ryan of the MATS-1 Squadron at Yuma has recommended

tactics in his paper "Some Thoughts on Killing Helicopters." These are the best tactics I have found so far, and fixed wing attack squadrons could well use these in their training programs.

Overall Discussion--So the R&D, testing and system acquisition should begin immediately. As a minimum for training, pilots attending the bi-annual MATS-1 "Weapons-Tactics Instruction" courses should receive some air to air missile delivery training.

It is possible that dog fights in helicopters (like WWI and WWII fixed wing gun duels) are already obsolete before they even began. If both sides have air to air missiles they will probably concentrate on their other missions. But if one combatant has air to air missiles and the other does not, it will be no contest. It is very probable the HIND will have air to air missiles in the near future.

Development is currently under way on higher speed, more survivable helicopters and VTOL aircraft which will be discussed in the next section. However, it looks like the 1990's before any of these exotic machines will be sitting on Marine Corps flight lines. The speed will help then but something is necessary now to counter the HIND threat. When you consider that in this age of "smart weapons" and "PGMs" a helicopter with an air to air missile could theoretically shoot down an attacking 500 knot plus fixed wing maybe all that speed is not as important (at least right away) as improvement in armament.

FUTURE DESIGN RECOMMENDATIONS

First let's list the principal basic qualities that I believe a combat machine of future should have:

1. Maneuverability.
2. Survivability (redundancy and hardened).
3. Capabilitity of high speed for short periods.
4. Easily maintainable (current helicopters with all their shafting require extensive maintenance).
5. Modern cockpit--excellent visibility, designed for new systems (i.e. heads of displays, fly by wire, ordnance systems).
6. Appropriate armament.
7. Appropriate survival systems.

The HARRIER is at one end of the spectrum of modern combat flying machines (primarily fixed wing that can fly slow). So now let's look at the other end of the spectrum (primarily rotor craft that can fly fast).

Machines at the rotor end of spectrum are able to carry external loads and truly "live" in slow flight environment. Most of these that are available now are compound helicopters (single rotor helicopters with short wings and an additional engine). Because of "retreating blade tip stall" these machines do not solve the speed and aerodynamics problem they only push against it. The US Army's new AAH is of this type of design and even though it has some improvements in armament, hardening, and other systems it is still a single rotor helicopter with the same speed limitations and also the maintenance problems associated with a tail rotor and the accompanying shafting. Another design, "the Tilt Wing" has tremendous problems with center of gravity movements.

However, there is one more machine and although it is still under development it is certainly worth attention. This is the Sikorsky Advancing Blade Concept (ABC) machine. It is a co-axial machine that unloads the retreating blades and balances the advancing blades at higher speeds thereby allowing much higher speeds without a wing. This concept also allows exceptional maneuverability. The tail rotor and shafting is completely eliminated and would reduce maintenance considerably. It should be noted that this machine is still under development and more work must be done in the areas of vibration control and directional control at slow speeds. However, everything done so far looks very good--the ABC is a flying prototype and has been for quite some time. This may well be our best hope if we want to "leap frog" the Russians in flying machine capability rather than struggle along slightly behind them.

The systems that should definitely be included in any future machine are:

--Inertial Navigation System

--FLIR

--Radar Warning Receiver

--Survivability Systems

--Air to Air Missile system

And if it is used in an attack role the following should also be included:

--High Rate of Fire Gun with High Energy Ammunition

--Heads Up Display

--Laser Range Finder

--Lead Computing Gunsight

FOOTNOTES

1. George Haering, "Analogies and Implications From Fixed Wing ACM," U.S. Army Aviation Digest, April 1978, p. 8.

2. Lynn M. Hansen, Lt Col (USAF), Edinburgh, "Soviet Combat Helicopter Operations," International Defense Review, 8/1979, p. 1242.

3. Ibid., p. 1243.

4. Department of the Navy, USMC Assault Support Helicopter Tactical Manual, NWP 55-9-ASH Volume I (NAV AIR 01-1ASH-1T), Washington, D.C., June 1978, p. 12-6.

5. Ibid., p. 4-4.

6. Ibid., p. 4-5.

7. MAJ Ryan (USMC), Yuma, Arizona, "Some Thoughts on Killing Helicopters," p. 9.

BIBLIOGRAPHY

"ABC--A Breakthrough in VTOL Technology," Special Summary - Sikorsky Aircraft, Stratford, Conn.

Browne, BG Edward M. (USA). "On the Attack Helicopter," U.S. Army Aviation Digest, January 1979, pp. 2-7.

Haering, George. "Analogies and Implications from Fixed Wing ACM," U.S. Army Aviation Digest, April 1978, pp. 7-11.

Hansen, Lynn M., Lt Col (USAF), Edinburgh. "Soviet Combat Helicopter Operations," International Defense Review, 8/1979, pp. 1242-1274.

Kennedy, Dr. Robert. "Precision ATGM's and NATO Defense," Military Issues Research Memorandum, Strategic Studies Institute, Carlisle Barracks, PA.

"MIL HIND D," Air International, February 1979, p. 70-72.

Miller, Retnae H., Lt Col (USA). Air Superiority at The Treetops," Military Review, March 1979, pp. 2-9.

Morrison, Philip and Paul F. Walker. "A New Strategy for Military Spending," Scientific American, Volume 239, October 1978, pp. 48-61.

Ryan, MAJ (USMC), Yuma, Ariz. "Some Thoughts on Killing Helicopters."

"Sikorsky Type a V/STOL Weapon System," Executive Summary, Vol. I. Sikorsky Aircraft, Stratford, Conn., 31 May 1977.

US Army. Field Manual No. 17-50: Attack Helicopter Operations, Washington: 1 July 1977.

US Army. Field Manual No. 90-1: Employment of Army Aviation Units in a High Threat Environment, Washington.

US Department of the Navy. USMC Assault Support Helicopter Tactical Manual, NWP 55-9-ASH Volume I (NAVAIR 01-1ASH-1T). Washington: June 1978.

Washam, Frank CWO and PFC Charles Rowe (USMC). "Those Wonderful Wind Machines," Naval Aviation News, May 1972, pp. 25-31.