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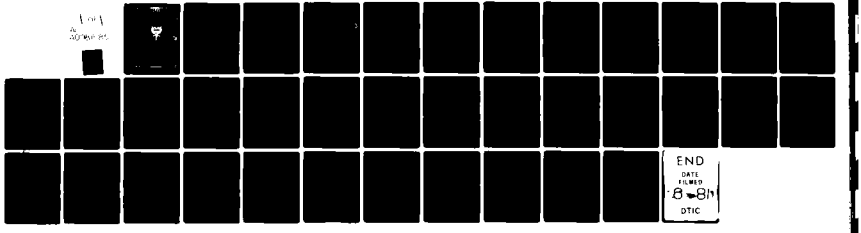

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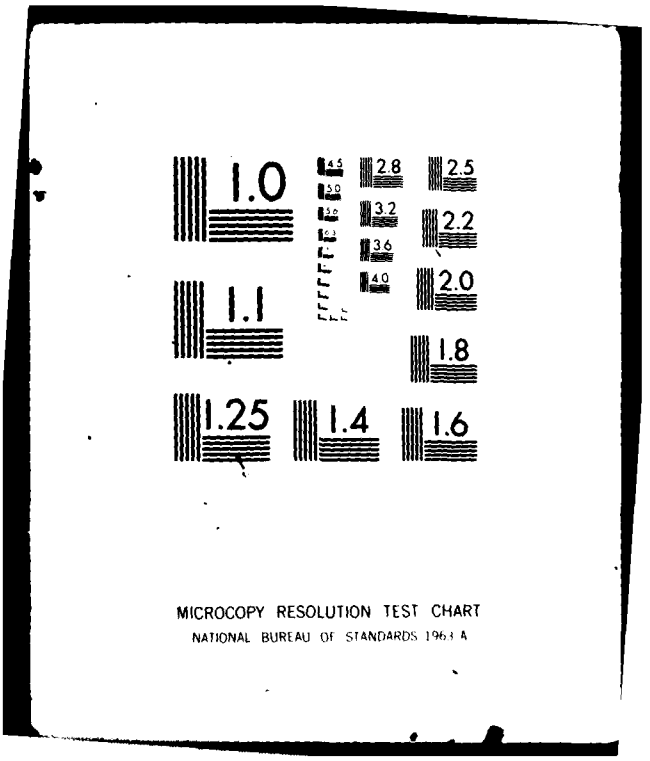
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STUDENT RESEARCH REPORT

SOVIET AIR DEFENSES AGAINST
ATTACK HELICOPTERS

MAJ Brian P. Mullady

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SOVIET AIR DEFENSES AGAINST ATTACK HELICOPTERS.

Major Brian P. Mullady

January 1980

DEPARTMENT OF THE ARMY
U.S. ARMY RUSSIAN INSTITUTE
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FOREWORD

This research project represents fulfillment of a student requirement for successful completion of the overseas phase of training of the Department of the Army's Foreign Area Officer Program (Russian).

Only unclassified sources are used in producing the research paper. The opinions, value judgements and conclusions expressed are those of the author and in no way reflect official policy of the United States Government, Department of Defense, Department of the Army, the US Army Intelligence and Security Command, or the Russian Institute. The completed paper is not to be reproduced in whole or in part without permission of the Commander, US Army Russian Institute, APO New York 09053.

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JOHN G. CANYOCK
LTC, MI
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SUMMARY

In this paper the author reviews current Soviet military literature in an effort to determine vulnerabilities in their air defense against low-level attack helicopters. He examines air defense philosophy, Soviet small arms, the SA-7 and the ZSU-23-4 at the Soviet battalion level. Although there are several vulnerabilities which can be exploited, the author concludes that the primary threat to helicopters is the Soviet ZSU-23-4. Changes to current U.S. antitank helicopter training and tactics are recommended in order to enhance the helicopter vs. tank kill ratio.

CHAPTER I

INTRODUCTION

In June 1972, Phase IV of the "Joint US-German-Canadian Attack Helicopter Evaluation" was conducted near the town of Ansbach, West Germany, and came to be known as the "Ansbach Trials". The test was designed to determine how well attack helicopters would fare in a European environment against attacking enemy armor, including the type of anti-aircraft weapons typically employed by the Soviet forces. The results of the test were as follows: 18 enemy tracked vehicles destroyed for each attack helicopter lost, or 13:1 if the scout helicopter casualties are recorded. What many tend to forget (and, in all honesty, it was not widely publicized) is that US pilots killed only 8.6 aggressors per anti-armor helicopter lost, whereas the combined record of the German and Canadian pilots was 41.7 aggressors killed per helicopter lost.[1]

Since the US pilots were at least as proficient in the AH-1G Cobra as their NATO counterparts, and as a group had far more flight hours recorded in the aircraft, what caused this startling difference? The report of the evaluation explains it this way: "The German and Canadian pilots ... appeared to have a better appreciation of the European terrain and of the application of nap-of-the-earth flight techniques, generally selected better firing positions, and had a better grasp of the tactical situation and likely aggressor actions."[2]

The primary purpose of this paper is to aid in eliminating this type of difference in the future. Specifically, information will be provided which will assist the attack helicopter pilot and ground commander in solving the last three problem areas mentioned in the test report, namely: selecting better firing positions; understanding the tactical situation; and predicting likely aggressor actions.

First, basic Soviet air defense philosophy will be examined for background and potential vulnerabilities. Then the three primary air defense means of the motorized rifle and tank battalions will be examined: Soviet small arms, both individual and vehicle-mounted; the SA-7, the shoulder-launched Soviet equivalent to the US "Redeye" missile; and the ZSU-23-4, the Soviet self-propelled four-barrel 23 mm automatic antiaircraft weapon assigned at regimental level.[3]

The primary sources are Soviet, especially the monthly publication, Voyennyy Vestnik (Military Herald).[4] Although much fresh literature has been published by the Soviets during the last several years concerning the employment of such weapons as the SA-7 Strela and ZSU-23-4 antiaircraft gun (hereafter referred to as the "ZSU"), precious little regarding the capabilities of these weapons has been published by the Soviet press. The real value of Soviet literature is to be found in their descriptions and explanations to their own forces of the anti-aircraft tactics to be used and methods of weapon employment. This information, together with Western data concerning weapons capabilities, provides the clearest possible picture of the low-level antiaircraft system presently employed by Soviet forces and is of the greatest value to pilots and air and ground commanders alike. Finally, drawing strictly on Soviet sources concerning their tactical exercises is one of the best ways to achieve any degree of predictability regarding likely aggressor actions in combat.

Such works as Nastupleniye (The Offensive) and Tank Batal'on v Boyu (Tank Battalion in Combat) both demonstrate that Soviet open-press sources frequently

offer the reader valid, accurate and predictive information. In fact, so much interest has been generated in the Soviet press concerning attack helicopters that during the last year a new abbreviation has been appearing in their texts and on their tactical maps: "VOP" (Vertolet Ognevoy Podderzhki) "Fire Support Helicopters",[5] to indicate attack helicopters.

Additionally, much information can be obtained from the way the Soviets discuss our expected tactics with attack helicopters. They read and critically evaluate Western open-source material and have become considerably concerned with the importance of Western air power, citing "foreign press reports that as much as 50 per cent of effective fire potential in the tactical zone belongs to aviation."[6] A 1977 article in Aviatsiya i Kosmonavtika quotes from the International Defense Review and Aviation Week concerning the West's employment of attack helicopters, discusses the ill-fated Cheyenne helicopter (AH-56), modification of the AH-1G, the "Ansbach Trials" and the development of the "Hellfire" missile.[7] Some of this reporting is quite accurate and detailed. For example, a recent article by Lieutenant Colonel N. Molchanov described US helicopters launching ATGM's from 2-3km range and taking approximately 25-40 seconds to detect and destroy armored targets. He states that "the time for searching and detecting the target is reduced to seven seconds when a laser guidance system is used."[8] Other Soviet sources are not as accurate in their descriptions of attack helicopter tactics. From this second category of articles, Soviet misconceptions should be made known as an area to be exploited in actual combat.

In this sense the following will be quite different from most accounts concerning Soviet air defense. Instead of reporting and emphasizing the strengths of Soviet air defenses, an attempt will be made to determine their vulnerabilities. Further, ways to exploit these vulnerabilities in their air defense philosophy, their weapons systems or their techniques will be suggested.

In nearly every scenario of a Warsaw Pact attack on Western Europe, the anti-tank capability of NATO attack helicopters is one of the critical factors in determining the outcome of the first few hours and days of the battle. There will be no time to pass on the "lessons learned" which so increased the effectiveness of our aircraft in Vietnam. US Army aviators must lift off on their first mission knowing what to do--in short, how to fight, survive and win. Based on the Ansbach trial results, an assumption can be made that everyone associated with Army aviation needs to know far more than he presently does about the Soviet threat.

In preparing this report, it has been necessary to impose certain limitations to keep it to a manageable size and pertinent to attack helicopter employment. First, this report examines primarily the air defenses of a typically deployed Soviet battalion. It is this unit (with normal augmentation) which is considered by Soviet military literature as the basic combat unit. There is also much more open-source material available here than at higher levels. And the weapons which pose the greatest threat to attack helicopters (small arms, SA-7 and ZSU-23-4) are most plentiful here.

Secondly, only low-level Soviet air defenses are being discussed here. Once the attack helicopter pilot begins to climb on the European battlefield, he becomes vulnerable to an increasingly greater arsenal of air defense weapons. The airspace from 100 feet to several miles above ground level requires far more sophisticated means of antiaircraft defense. A recurring theme throughout the report will be that current US attack helicopter employment fails to emphasize strongly enough the importance of destroying Soviet air defense weapons in the first engagements.

The oft-repeated phrase "Attack helicopters have one mission--kill tanks!"[9] is wrong. The attack helicopter battalion commander who said "They pay me to kill tanks, not ZSU's"[10] is, in essence, wrong. Attack aircraft's first priority should be to destroy or suppress air defenses, then to provide the necessary fire support required by the ground commander. This does not mean that attack helicopters should waste time searching for air defense weapons. This is the job of scout helicopters, ground forces, etc. This simply means that attack helicopters should destroy, wherever possible, Soviet ZSU-23-4's. This is not now our clearly stated tactic; it is not emphasized or even tested in current evaluations and may result in pilots attempting to avoid ZSU's while seeking out tanks in the initial engagements. The following sections will support the validity of this conclusion

CHAPTER II

SOVIET AIR DEFENSE PHILOSOPHY

Most Western authors depict the Soviets as possessing the best air defenses of any army in existence today. There is always the graphic representation before the reader's eyes of a series of overlapping air-defense "umbrellas" provided by various weapons which begin with small arms fire against the lowest and closest air targets to weapons systems which can destroy a U-2 at maximum altitudes. Some writers have even suggested that the lethality of Soviet air defenses has had the effect of neutralizing aviation as a weapon on the European battlefield.[11] However, the "total" coverage attributed to Soviet air defenses is accurate only when Soviet units are stationary or in the defense. As soon as they begin to move, the air defense system--and, especially, the low-level system--will be degraded. Further, Soviet units will most likely be encountered while moving.

Soviet air defense concepts are in accord with their experiences in World War II. The Soviets vividly remember 22 June 1941, when the German army launched Operation Barbarossa with an unmerciful attack of 5,000 aircraft which was spectacularly successful.[12] However, the Soviet military does not plan to fight the next war as it did in 1941. They have witnessed the use of our helicopter and close air support aircraft in Vietnam. They have examined the experience of air defense forces in the Middle East wars. Their view of today's battlefield is quite different. Due to the availability of tactical nuclear weapons on the modern battlefield, the Soviets conclude that large concentrations of forces will become immediate targets. Therefore, Soviet units in the attack will be brought from relatively secure positions well behind the line of immediate contact.[13] The result is that Soviet columns on the move will be the typical encounter.[13] The Soviet textbook, The Offensive, describes armored assaults across a broad front, spearheaded by independently maneuvering columns advancing 100 kilometers per day, maintaining wide gaps between columns to avoid destruction by NATO's nuclear weapons, rapidly crossing radioactive zones, bypassing the great floods, fires, and destruction caused by nuclear detonations. The battlefield will be gigantic in comparison with past wars and the Soviet advance will be characterized, above all else, by a rapid tempo of attack.[14] Speed of the Soviet column is expected to lie in the range of 12-20 miles per hour,[15] vehicle intervals will be approximately 100 meters,[16] and, during the approach march, tanks are expected to continue to move while under fire from attack helicopters, in fact increase their speed, and will not return fire against them.[17]

The fact that armor is the heart of the Soviet-led Warsaw Pact doctrine and tactics is clearly reflected in the writings of Soviet military leaders. Colonel A.A. Sidorenko, Doctor of Military Science and member of the faculty of the Frunze Military Academy, has written:

> "... [all] offensive actions will be conducted primarily in tanks ... Battles in dismounted combat formations are only where the enemy offers strong resistance and where the terrain hinders the actions of the maneuver battalion on vehicles."[18]

This concept goes back well before the 1970's. In the 1962 publication, Military Strategy, Marshal Vasiliy Sokolovskiy declared that:

> "An offensive should be mounted using primarily tanks and armored troop carriers. Dismounted attack will be a rare phenomenon. Mechanized firepower and maneuvers of troops in vehicles will now reign on the battlefield."[19]

Given this Soviet view of the modern battlefield--the emphasis on speed, dispersion and armor--how are air defenses employed to support this type of warfare? What is the air defense philosophy? What are the basic principles?

A review of Soviet military publications concerning the roles and missions of their air defense forces indicates that the operative principles which are constantly repeated are "deployment in mass", "mobility", "dedication to mission", and "continuity". "Deployment in mass", in the simplest definition of the concept, means that the discovery of one antiaircraft weapon by US forces will indicate that another is nearby. For example, it would violate basic Soviet air defense philosophy to assign one ZSU-23-4 mount to independently defend a unit, particularly one on the move. However, this principle of "massing" air defense weapons is often misunderstood in Western literature. It does not mean great numbers of air defense weapons per se, rather that air defense systems are employed in pairs. As an example of this misconception, one author has stated that the ZSU-23-4 "will comprise the tank company's self-screening AAA cover. They may be alloted on the basis of perhaps two air defense units per tank company (10 tanks), a 1:5 ratio."[20] This is true for the leading two companies of a tank regiment, but what of the other seven tank companies and the assorted support units? A Soviet tank regiment has 118 armored vehicles, and only four organic ZSU-23-4 mounts to provide air cover for the entire regiment.[21] The typical Soviet motorized rifle regiment is even less supported by its organic ZSU-23-4 mounts. With 146 armored vehicles assigned, there are still only four organic ZSU-23-4 antiaircraft gun mounts assigned.[22] There are also 36 SA-7 "Strelas" assigned to this regiment,[23] but the effectiveness of this weapon against attack helicopters is not clearly established and will be discussed later.

The concept of "deployment in mass", then, simply indicates that the antiaircraft weapons will typically be assigned in pairs with the forward echelons of an attacking formation or while covering the front and middle of a battalion acting as the advanced guard.[24] They will not be "massed" in the sense that tanks will be massed and the attack helicopter pilot will see far more armor vehicles than he will antiaircraft mounts.

The concept of "mobility" means that air defenses are designed to maintain the same speed as the units they are covering. This principle implies several things to the attack helicopter pilot. Fresh attacking Soviet units, regardless of how far and rapidly they have travelled, will have antiaircraft mounts organic to the leading elements. It also should imply that once the antiaircraft guns

have been detected, they should be engaged immediately since they will not be there again. Finally, the attack helicopter pilot should be aware that the effectiveness of a moving antiaircraft gun is severely degraded. This is due not only to the smoke and terrain-induced movement of the mount--but primarily to the difficulties in visually detecting the attacking helicopter while keeping up speed in a rapidly moving column.[25] When under an attack, the ZSU's in column may either fire on the move (with less accuracy) or perform a "leap-frog" tactic (firing from a short halt while the other ZSU rushes toward the front of the column, and then reversing roles).[26] Leap-frogging provides for more effective fire, but also allows the ZSU to become a better target and it can only be used when there are at least two ZSU mounts in column. Obviously, if the first target struck in column were a ZSU-23-4, the "leap-frog" tactic could not be employed. If it were the lead ZSU, the fire of the second would be severely degraded as it rushed to a more forward position in the attacked column. Although SA-7's can be fired by a gunner standing in the rear hatch of a Soviet BMP (Armored Personnel Carrier), it is hard to see how his fire would be effective against a helicopter hovering low, head-on (lowest infrared profile), and at maximum range.

"Dedication to mission" is a constantly repeated basic principle of the air defense assets of the battalion. In his textbook, Antiaircraft Subunit in Combat, Lieutenant General V.A. Gatsolayev expressed the philosophy of "dedication to mission" when he wrote:

> The essence of an antiaircraft podrazdeleniye's [note: any size unit below regiment] combat mission can be expressed with two words "to cover". The term "to cover" could equally be replaced with the phrase "to defend against danger from the air" or even more precisely, "to prevent strikes and reconnaissance of the target from the air." In other words, the antiaircraft podrazdeleniye engages in battle against an air enemy not generally, but in the interests of certain forces or rear services facilities.[27]

This, it is stressed in Soviet sources, includes not firing upon a clearly hostile aircraft when doing so might endanger its supported unit or compromise the supported unit's position.[28] This information is important to the attack helicopter pilot. In fact, a lack of immediate fire from a detected Soviet unit on the march may be the rule, rather than the exception.

In a 1975 article in Voyennyy Vestnik, it was emphasized that a single aircraft will normally not be engaged, to avoid giving away the location of a battalion, unless it attacks the battalion directly. The article praises air defense troops who allowed a "scout helicopter" to fly directly over the supported unit.[29] Another Soviet article praises an antiaircraft unit for holding its fire in order to bring down two aircraft instead of one by drawing them "into a space from which [they] could not escape unpunished."[30]

In addition to Soviet air defenders' "dedication to mission", there are several other examples of antiaircraft gunners holding their fire and being praised for doing so. Due to the self-perceived effectiveness of their air defense weapons, the Soviets have stressed that air defense weapons themselves may become lucrative targets for attack. There is much to indicate that air defense weapons may be counting on surprise, not opening fire until there is a clear certainty of destruction before giving away their positions.[31]

Identification of enemy aircraft will be a problem in a European mid-intensity environment. The Soviets must always consider the possibility of shooting down

one of their own.[33] The result of this possibility, coupled with the Soviet emphasis on a highly centralized command, leads to an extrmemely strict firing discipline.

The Soviet soldier and ZSU-23-4 gunner alike simply do not open fire until they are told to do so; and, even then, not until they are told which target and where. In a 1977 article in Voyennyy Vestnik, the following excerpt is typical of the emphasis in this area:

> During the exercises ... the "evening's" first reconnaissance helicopter was detected by squad commander Guards Junior Sgt. A Komushin. By the agreed-upon signal, he immediately reported that fact to the commander of the 3rd company, Guards Senior Lieutenant V. Stolyarov. And it was then that a substantial error was made. Instead of concealing the location of the battalion on the pass and allowing the helicopter to get through, the officer gave the order to open fire, thus revealing the company's strong point.[33]

From the standpoint of looking for vulnerabilities, this tendency to delay fire for any number of reasons certainly stands out as an advantage to the attack helicopter pilot. Indications are quite clear that the airground engagement may not be of the "quick draw" variety that NATO exercises, our tactics and tests seem to stress. If the Soviets choose to delay fire until the unit is clearly detected and attacked by enemy air, the obvious first target should be a ZSU mount, the weapon most lethal to the attacking helicopter.

The principle of "continuity" is closely related to mobility, but stresses the idea that air defense coverage must be provided for the supported unit in all tactical situations. Under no circumstances will the air defense assets allow themselves to be separated from their supported unit. The message is constantly repeated in Soviet publications that the most serious mistake an antiaircraft battery commander can make is to allow his ZSU mounts to fall behind the column for any reason. In some cases this philosophy has been carried to the extreme of not allowing ZSU's to fire from a short halt for fear that they would fall behind the unit.[34] Soviet writers stress this while at the same time stating that a moving column is most vulnerable to air attack.[35] An air defense philosophy which stresses "continuity" of air defenses to the detriment of air defense effectiveness increases the psychological impact on a Soviet unit deprived of its air defense mounts, which is another argument for destroying the air defenses at every opportunity.

In addition to the four basic principles of Soviet air defense philosophy discussed above, there is another recurring theme which, while considered a strength, also reveals a potential vulnerability. The Soviets conduct most of their exercises in an environment which emphasizes either radio silence or a loss of communications due to enemy "jamming". Soviet aircraft and helicopters are constantly depicted in the open press as providing a visual signal to the Soviet ground forces which indicates "I am one of your's". During maneuvers Soviet aircraft execute a predetermined maneuver, launch colored rockets (or flares), or turn on navigation lights to allow ground observers to confirm their identity.[36] The system is vulnerable and can be exploited by discovering the Soviet signal for "I am one of your's" and using it just before the attack. Naturally, such a ploy is not without risk, but it would confuse an antiaircraft gunner for a few critical seconds, and it could allow an aircraft under ground attack the possibility of a "cease fire". If used several times, there is also the possibility that ground observers would begin to distrust the compromised visual signal and fire on their own aircraft. The first Soviet prisoner

should be questioned concerning the visual signal and any discovery of such a signal by friendly ground or aviation personnel should immediately be reported and exploited.

Also, Soviet literature nearly always describes the use of colored flares fired in the direction of an aircraft as the signal to notify the unit of a hostile sighting and also to command the unit to open fire.[37] The Soviet practice of strict fire discipline could lull the attacking aircraft into thinking that they have not yet been detected. However, an exposed pilot, observing a visual signal from a Soviet troop unit, should expect immediately to receive fire. Additionally, the launch point of the flare should be noted: a unit commander, and a lucrative target, has just given his location in the column.

Although the vulnerabilities of the Soviet low-level air defense philosophy have been discussed, it must be stressed that many of these vulnerabilities exist only when the unit is moving. When a Soviet battalion is stationery or in a defensive role, these philosophical principles act as strengths.

Soviet doctrine clearly indicates that the "defense" is always a forced and temporary condition. During all defensive operations, the emphasis will be on inflicting maximum damage on an attacking enemy.[38] This aggressive attitude is certainly reflected in the role of the air defense. Unlike the fluid and dynamic character of the offensive, Soviet air defenses will be characterized by ambushes, roving guns which are actively seeking targets of opportunity, and all-around unit coverage by overlapping fields of fire and observation. Camouflaged antiaircraft positions will be shifting to deceive aircraft and hide the unit's true location. Antiaircraft guns and SAM weapons of higher command echelons will be integrated with those of the battalion Finally, fighters and interceptors of Soviet Frontal Aviation can be expected.[39] As one Soviet author writes, "helicopters will not be able to attack from the flank or the rear. They may try, but to do this they will have to cross an air defense zone which has both reconnaissance facilities and weapons for destruction of air targets; they will have to fly over various locations screened by air defense troops, and consequently they can be detected and destroyed."[40]

A review of Soviet air defense literature indicates that attacking a prepared Soviet defensive position is not a mission for aircraft unless the attack is part of ground attack, well supported by artillery. Even then, losses of attacking aircraft will be high.

CHAPTER III

SOVIET SMALL ARMS

Too little has been written concerning the importance of small arms and individual weapons against attack helicopters. In the numerous articles discussing the more sophisticated Soviet air defense weapons, it is easy to lose sight of the fact that a lone AK-47 gunner, within the proper range, can have the same effect on an attack helicopter as the most sophisticated defenses, he can destroy it.

The small arms weapons of the tank and motorized rifle battalions are indeed a serious threat, if only because they are so numerous. For example, a motorized rifle battalion will have approximately 201 AKM's available and the 31 BMP/BTR's (APC's) of the battalion will add an additional 31 7.62mm machine

guns and, in the case of BTR's, 31 additional 12.7mm or 14.5mm antiaircraft machine guns.[41] Each of the 31 tanks in a tank battalion mounts a 7.62mm machine gun and are often seen with a 12.7mm or 14.5mm antiaircraft gun.[42]

Soviet troops are trained to use their individual and vehicle-mounted weapons in an air defense role. The philosophy of small-arms weapons against air targets is that these weapons will be massed against individual targets. One Soviet author stresses the psychological factor of massing fires when he writes, "Under conditions of intense fire opposition, pilots are forced to maneuver, climb and shorten aiming times. All this lowers the effectiveness of on-board systems."[43] The Soviet training and exercise literature make it quite clear that, in a stationary or defensive role, the optically-sighted small arms weapons will probably form the bulk of the threat against air assault operations.[44] And, it is stressed, "Firing as a unit is the most effective means of engaging aerial targets."[45]

However, in looking for vulnerabilities, the most obvious is that the individual weapons are generally unusable when the unit is moving. The AKM's will be with the soldiers in the tanks or APC's. They will not normally be available during the attack either, if we are to accept the Soviet concept that dismounted attacks will be the exception on the modern battlefield.[46] Also, when the unit is moving, the accuracy of the vehicle-mounted weapons drops correspondingly.

Since these weapons are all optically sighted, the gunner must first visually acquire the target, relay the information to his commander, the commander must acquire the target, relay the location to the firing unit, and give the fire command for massed fire. All this takes time. And in low-light conditions, bad weather or brief unmaskings by the helicopter, the pilot has the advantage.

Additionally, the attack helicopter has a great range advantage and this is the best defense against small arms fire. The AKM is credited with a maximum effective range of between 300-400 meters. The 7.62mm machine gun is effective to 800 meters and the 12.7mm and 14.5mm can reach approximately 1,000 meters.[47] An attack helicopter pilot, having discovered a unit without ZSU's attached, or after the ZSU's have been destroyed, might press the attack to within one kilometer but he should go no closer.

Attack helicopter pilots should know that all of these weapons are dual-purpose weapons. They are designed for both air defense and ground roles. The 12.7mm and 14.7mm guns especially have a direct fire role in actual combat.[48] In other words, a Soviet unit in the offense would have far fewer of these weapons available for air defense. In fact, several Soviet authors stress the point that "Fire of rifle weapons must not be at aerial targets if it detracts from the main mission of the destruction of the enemy's ground forces."[49]

There are also indications in the Soviet military press that they do not completely understand our attack helicopter tactics. They may be expecting attack helicopters to be much higher and moving more rapidly than will be the actual case. One article describes infantrymen firing at enemy helicopters "while lying on their backs."[50] Another article written in 1979, boldly states that "Scout helicopters are expected to be at altitudes up to 800 meters."[51] The clearest picture of their small arms techniques against helicopters appeared in Starshina Serzhant in an article entitled "Low Altitude Target". The author writes that targets will normally be engaged at ranges of 700-900 meters. There are two types of fire: "defensive fire" and "accompanying fire". "Defensive fire" is used against air targets moving at speeds greater than 270

knots (nautical miles/hour) and consists of placing concentrated fire in front along the course of the target's flight path "in order to ensure the meeting of the target with the bullets' cone of fire."[52] "Accompanying fire" is conducted by following the target's movement during firing. This type of fire will be used against attack helicopters. He then explains how to lead the helicopter: "It is useful to remember that during firing at the range of 100, 300, and 500 meters, the helicopter is led by 1, 3, and 6 body lengths respectively."[53] This would seem to indicate that Soviet gunners are taught to lead slow-moving attack helicopters by too great a figure. Helicopter pilots should be aware that when receiving massed fire while moving at the nap-of-the-earth (NOE) airspeeds (less than 50 knots), most rounds will be passing in front of the aircraft.

The author mentions that tracer rounds should be at least 1:4 and that "firing will only be at the order of the commander."[54] Unit-delivered small-arms fire is even more directly controlled than that of dedicated air defense weapons in order to provide effective massed fires and to avoid shooting at friendly aircraft. A typical firing command is really quite lengthy: "From the front--three helicopters. Squad, at the helicopter above the grove, lead one aircraft length. Fire!"[55] Obviously the more helicopters visible to the unit, the more complicated becomes the command. This all takes time.

Although small arms antiaircraft fire represents a serious threat to the attack helicopter pilot, it can generally be avoided by knowing the exact location of the enemy unit, using maximum firing ranges and minimum exposure times. Particularly dangerous would be an air attack against a Soviet unit in a defensive role. Their emphasis on camouflage and assignment of horizontal and vertical fields of fire could trap a low-flying aircraft within small arms range. The effectiveness of small arms against helicopters during Soviet movement or attack is severely degraded. In fact, the first actual test of attack helicopters against tanks proved this dramatically. During Lamson 719, the cross-border operation into Laos, conducted from 8 February to 9 April 1971, US attack helicopters were employed against a North Vietnamese tank assault on Fire Base 31. The commander of the attack helicopters in the mission writes the following account:

> The majority of the enemy tanks seen were T-34's mounting either an 85mm or 100mm main gun, a 12.7 and 7.62mm turret machine gun. The remainder were PT 76's mounting what was believed to be a 76mm main gun and a 12.7mm AA gun and a 7.62mm turret machine gun.
>
> We reported a total of forty-seven tank engagements. In all cases the tank used its 12.7mm gun in defense. In some cases the tank used its 76mm or 85mm gun in defense. Most tanks were protected by troops and other weapons. We did not lose an aircraft or crew member from a helicopter-tank encounter [emphasis added] ... we reported ... six tanks destroyed, nineteen immobilized and eight damaged by helicopters.[56]

In short, Soviet ground fire can be avoided by precisely locating enemy units and maintaining greater than a one kilometer range. The air defense role of Soviet small arms would, of course, increase as other means are destroyed.

CHAPTER IV

THE SA-7 "STRELA"

As is the case with Soviet small arms fire, the US has had experience flying against the SA-7. It is a shoulder-fired air defense missile system which has been produced by the Soviet Union specifically for employment against low, slow-flying aircraft. It uses a passive infrared homing system, and its characteristics are reported as being quite similar to the US-produced "Redeye". And, as the "Redeye", it is used for company level air defense. First observed during the Arab-Israeli war of 1967, it is reportedly produced in two versions. The SA-7A missile reaches a speed of approximately 1,000mph and has an effective range and altitude of about two miles. The SA-7B travels at approximately 1,300mph with a maximum effective range and altitude of about three miles. If it misses the target, the missile is reported to self-destruct 15 seconds after launch (about 4 miles down range). Each SA-7 team is composed of a gunner and assistant gunner, each carrying one missile.[57]

The SA-7 is the only organic, dedicated air defense weapon available to motorized rifle and airborne battalions. It is not issued to tank battalions.[58] Normally it is regarded as the SAM system which compliments the ZSU-23-4 gun system usually found at these levels of organization. Each company is assigned a section of three SA-7 gunners, making a total of nine SA-7 gunners in each battalion.[59] Since each BMP has a storage rack capable of transporting one SA-7 missile,[60] there is a potential for a battalion to carry a basic load of up to 30 SA-7 missiles. In airborne units the SA-7 would be complemented by the six regimental level ZU-23-2's.[61] This weapon, unlike the ZSU-23-4, has no radar control, is not self-propelled, and offers only half the fire power of the four-barrelled ZSU-23-4.[62]

A review of Soviet literature concerning the SA-7 indicates the Soviets have faith in its ability to bring down low-flying helicopters.[63] No doubt their optimism in these weapons stems from its reported effectiveness when first employed in 1972 in the Vietnam conflict. One Western source reports that one helicopter was downed for every three SA-7's fired in Vietnam.[64]

Soviet military literature indicates how the Soviets plan to employ this weapon in a modern war. In the assembly area, SA-7 gunners will be assigned sectors of responsibility but will stay with their companies. They will be primarily orientated on the most probable low-alititude approaches into the area. They are usually deployed on line facing the most dangerous avenue of approach or in a triangle with the apex facing the most probable direction of attack.[65]

During the approach march and during the attack, the SA-7 gunners will proceed with their companies and one, as a rule, will be located in the same vehicle as the company commander.[66] The attack helicopter pilot should note that the BMP/BTR will usually make a short halt to allow the SA-7 gunner to fire while standing in the rear hatch.[67] It will probably be the only APC which suddenly halts during an air attack.[68]

In the defense, SA-7 deployment is similar to that in the assembly area. Sectors are assigned and primary target lines established for each probable low-level approach. The gunners will normally be positioned in a triangle formation within their company strong points and orientated on an assigned "primary target line".[69] The SA-7 gunners may also be positioned to fill in the gaps in radar coverage by the ZSU-23-4's. Finally, SA-7 gunners may be used, in

strength of a section (3 gunners) or more to establish an antiaircraft ambush.[70] This should be expected when there is only one low-level approach into the defensive area. Throughout discussions of air defenses in the defense, it is continuously stressed that at a minimum primary, alternate and reserve firing positions will be used by SA-7 gunners. After firing, the SA-7 gunner immediately relocates to a different preselected position.[71] Concerning the actual positioning of these weapons, one recent Soviet article described a rear area raid by airmobile forces establishing SA-7 ambush positions on the hill tops surrounding the objective,[72] and another 1979 article, describing a defensive position in heavily-wooded terrain, stated that SA-7 positions should be established on platforms located in the trees themselves.[73]

The Soviet tactic is to launch several of these missiles at one target. A Soviet Lieutenant General writes: "When the probability of destroying a helicopter with just one missile is very small, a subunit, according to the situation, can launch several missiles simultaneously, without waiting for the results of the first launchings."[74] This coincides with the experience of US pilots in Vietnam where it has been reported that helicopters were often fired on by multiple SA-7 rockets, occasionally as many as five at one time.[75] However, the US does not hold the same high opinion of the effectiveness of the SA-7 as do the Soviets. One report says the SA-7's low speed and altitude, short range and limited maneuverability reduce its effectiveness.[76] This, coupled with the requirement for the operator to do the ranging for the system and a delay from firing initiation to missile launch, "results in many missed targets."[77]

According to another report, the SA-7 can acquire and attack only helicopters presenting an aft view since the acquisition and attack angle is limited to a maximum of about 50^{o} off the tail of the target aircraft. Also, the missile can engage only aircraft flying above a minimum intercept alititude of 50-100 feet.[78]

It also appears from Western sources that the new AH-64 "Advanced Attack Helicopter" may be invulnerable to the SA-7 threat. One article states that US Army tests have shown that the AH-64, as a whole, is below the lock-on threshhold of any present or postulated infrared threat through the mid-1980's.[79] Another states that the AH-64 "black hole" passively cooled infrared suppressive exhaust ducts "would appear to eliminate the SA-7 as a threat."[80]

As stated above, reaction time is the most important factor in considering the effectiveness of Soviet air defense weapons against low-flying helicopters. It has been stressed as a vulnerability of the Soviet air defense philosophy and in their delivery of small arms fire. In this light, it is clear that the SA-7 has a severe disadvantage for use against suddenly-appearing, rapidly-fleeting air targets. How much time the SA-7 gunner actually needs to acquire and attack a target depends upon the circumstances, but he must aim the weapon at the aircraft until he is locked-on, warm up his gyro, initiate fire and wait for missile launch. All this would have to be proceeded by visual acquisition, identification and the command to fire. Additionally, nearly all recent pictures of SA-7 gunners preparing to launch show him wearing large goggles.[81] Does he put these on after detecting the target, thus losing more valuable seconds, or does he scan the sector with them on, thus reducing his field of vision, especially in rain and fog? It would appear that attack helicopters can prevent an SA-7 "lock-on" by staying as close to the ground as possible, staying near heavily wooded areas and presenting only a "head-on" target for the SA-7 gunner.

Finally, although ammunition for the ZSU is specifically mentioned as being carried by vehicles organic to the regimental antiaircraft battery, there is no mention of how SA-7 resupply is accomplished. Since the SA-7 is a company air defense asset, logically the additional rounds would be carried in the company's BMP's, meaning the company would be forced to halt to transfer missiles from the BMP's to the gunners. In other words, in active combat and on the march, the SA-7 gunners would be unable to reload. There may also be a drop in SA-7 activity as front line units expend their missiles with no resupply.

In summary, a review of Soviet and US sources indicates that the SA-7 is slow to employ and generally ineffective against attack helicopters, yet the Soviets appear to be counting on it.

CHAPTER V

THE ZSU-23-4 "SHILKA"

Unlike Soviet small-arms fire and the SA-7, the US has never flown against the Soviet ZSU-23-4. The ZSU-23-4 is a self-propelled, four-barrel 23mm automatic antiaircraft system mounted on a slightly modified PT-76 chassis. First seen in 1966,[82] it was specifically developed to provide low-level air defense for the motorized rifle and tank regiments. It has a four-man crew, carries between 1,300-2,500 rounds of 23mm ammunition in internally stored cannisters,[83] and is credited with a rate of fire of 1,000 rounds per barrel per minute. The ZSU is capable of firing on the move due to the integrated radar/gun stabilization system. The radar is reported to be excellent. The GUN DISH radar has a very narrow beam which not only provides for excellent aircraft tracking, but is also difficult to detect and evade. It is generally reported as having three modes of firing. However, the Soviets have described a fourth mode. The modes are: (1) radar control; (2) electro-optical (radar gives range only); and (3) optical.[84] The Soviets describe the fourth mode as "unique". They describe it in this way: "Work proceeds briefly according to 'remembered' coordinates of the target and their rates of change. Here, it is assumed that the target is moving evenly and in a straight line in any plane. The mode is put into effect if there is danger of losing the target by radar during its automatic tracking because of interference or inaccuracy."[85] Western sources claim the guns are capable of effective fire in the optical mode to 2,500 meters and, with radar, out to 3,000 meters,[86] although the Soviets claim an effective range of only 2,500 meters.[87] The weapon system is highly mobile but is not amphibious, having a fording capability of just over three feet.[88]

The ZSU radar may have an IFF capability. A 1979 article described a flight of friendly aircraft approaching a ZSU and reported that "the radar plotter received data that the targets were responding to the interrogation."[89] The ZSU is organic to the motorized rifle regiment and tank regiment with one battery of four ZSU's assigned. It is not organic to airborne units.

The complimentary SAM at regimental level is the SA-9. Almost nothing appears in the Soviet press concerning the SA-9. It is not employed at battalion level and, therefore, will not be discussed here except to say that it is generally described as a vehicular-mounted, improved SA-7. Many of the previously mentioned limitations of the SA-7 would apply to this weapon as well.

The Soviets hold the ZSU in high regard. The record of the ZSU in the 1973 Arab/Israeli war, when it was credited with about one-third of all Israeli aircraft losses, would indicate that it presents a formidable threat.[90]

Soviet military literature describes how they plan to use this weapon in combat. In the assembly area, regimental ZSU's will normally join the battalion which will be acting as the advanced guard for the march.[91] This battalion will normally be assigned the full battery of 4 ZSU's. In the assembly area, ZSU's will be assigned sectors to defend, paying particular attention to probable low-level approaches. During this period, detection of aircraft into the area will be accomplished primarily by visual observation and, perhaps, one of the ZSU's radar.[92] The Soviets are aware of our ability to detect their radars. A 1979 Soviet military publication stated in the assembly area "... it is inadvisable to use radar sets, except for those specially set aside to detect aerial targets. Otherwise, it is easy for the enemy, who has appropriate equipment available, to determine the number of operating sets, their characteristics and the combat formation, operating frequencies, and finally the probable composition of the forces being concentrated."[93] Since attack helicopter pilots have been trained to use their on-board AN/APR-39 Radar Warning Receiver to detect ZSU's, they should know that this sytem will not be reliable in approaching a Soviet battalion assembly area. It may detect one radar, but there will be four ZSU's.

On the march, the ZSU's may be anywhere within the column. It is the battalion commander's decision and much depends upon the level of air activity expected to be encountered. There are, however, two recommended methods of ZSU distribution within the column. If the column is moving without expecting a meeting engagement at a predetermined location, the ZSU's should be found in the column of the company with which the battalion command and observation post is moving.[94] If the air situation is particularly hostile, one ZSU will be positioned near the head of the column and another near the rear. The ZSU's will probably respond to air attack by firing from short halts and employing a leap-frog technique of fire and maneuver.[95]

When a column is moving to a meeting engagement at a predetermined location, the ZSU's are normally spaced at 500-700 meter intervals.[96] This column will probably not halt for an air attack and the ZSU's are reported to fire from the move while keeping their place in the column. Firing from the move is practiced quite frequently.[97]

There are two other "non-standard" variations concerning placement of ZSU's on the march. One Soviet source recommends deploying ZSU's along the most susceptible flank in the case where there is only one avenue of low-altitude approach or the possibility of a tank "killing zone" being created.[98] Another Soviet author recommends the variant of sending some of the ZSU's forward of the column to be ready to conduct fire before the approach of the screened companies and battalions.[99] He does, however, state that there are rarely enough AA mounts to do this.

Usually, the vehicle interval between all vehicles in column will be approximately 100 meters.[100] The interval between the ZSU's and other vehicles will be at least this great, perhaps even greater, so as not to hinder the ZSU's ability to detect and engage low-altitude targets and to prevent mutual damage when engaging targets.[101]

During the assault, the ZSU's will form a line of platoons with each platoon

(two ZSU's) supporting a first echelon motorized rifle company.[102] In the case of a regiment advancing with two battalions in the first echelon, each will normally be assigned a ZSU platoon. In any event, the ZSU's will be located, invariably, 300-400 meters behind the attacking tanks or BMP's, and, depending upon the width of the battalion sector, with a linear separation of 150-200 meters.[103] During exercises, Soviet officers have "stopped" the attack so that the ZSU mount commanders could pace off the interval to get it right.[104] According to Sidorenko, a battalion attacks on a front of 1 1/2 - 2km with two companies forward and the third company approximately 3km to the rear.[105]

During the assault, the ZSU's will display less strict fire control than during any other maneuver. Normally, they will fire based upon previously issued instructions and will fire at any aircraft which appears to threaten the supported unit. Interestingly enough, in two recent Soviet articles ZSU gunners were forced to decide between firing at fixed-wing attackers or helicopters which were simultaneously attacking the Soviet unit. The solution in both problems was to concentrate the fire on the helicopters first, and then the aircraft.[106] "The helicopters present the greatest danger for the tanks."[107]

Finally, it is interesting to note that ZSU's will very rarely be used in a direct fire, ground combat role. During one reported exercise a ZSU opened fire on an enemy APC. The author of the article criticized this action. "It is a very dangerous tactic", he writes, "which is allowed only when necessitated by self-defense measures."[108]

In the defense, the ZSU is a particularly dangerous air defense weapon. As the SA-7's in the defense are used to cover the most likely avenues of low-altitude approach. Vehicle tracks will be covered, the ZSU's will be camouflaged and most will turn the radars off in order to achieve surprise in the attack. In this case target data will be provided by higher headquarters. Only in the case of a battalion in the defense, separated from the regiment, are the radars left on.[109] Each ZSU will have predetermined alternate positions. After engaging an aircraft, the ZSU will move for its own protection and to deceive the air enemy as to the actual location of the air defenses and the unit supported.[110]

Although it is doubtful that a regimental or battalion commander would detach his small number of ZSU's for this purpose, Soviet sources have described the employment of ZSU's in aerial ambushes and "Roving guns". The authors make reference to the success of this tactic in World War II but do not explain where the weapons for this additional mission will be found. However, in both these roles the ZSU's will be employed in pairs and the radars will be off. In a 1978 Soviet military article, the ambush instructions were as follows: "In order not to be detected until targets appear in the fire zone, the platoon's radars do not operate. Data on every plane and helicopter during that time are received from the senior commander and observers."[111] The article goes on to explain that radio silence is also critical and that only one short signal of the readiness for firing is permitted.[112]

Roving guns are particularly dangerous. Generally, the battalion is responsible for the destruction of helicopters within a linear sector to the maximum range of the ZSU (3,000 meters), but roving guns usually maneuver outside the main defensive position and actively seek out encounters with enemy aircraft. They will aggressively engage any aircraft within range and then quickly proceed to a new location.[113] In short, the ZSU's are much more difficult to detect in the defense, are closely linked with higher level air defenses, and

are very effective.

Finally, there is one tactical meneuver which must be discussed due to the Soviet's special vulnerability to attack helicopters. The river-crossing operation presents a unique opportunity to the attack helicopter since the ZSU is not amphibious and, as a result, will not be able to continuously provide air cover throughout the operation. As a result, speed of crossing is emphasized continuously.[114] Initially, the ZSU's will assume firing positions approximately 300-500 meters before the water's edge to protect the tanks being prepared to snorkel across the river. A pair of ZSU's may be sent out to the flanks to defend the most likely avenue of approach, the riverbed itself.[115] In the case of a motorized rifle battalion, the SA-7 gunners will usually cross amphibiously with their companies. That is the extent of dedicated air defenses across the river until the ferries are put into operation.[116] The first vehicle to cross on the ferry will be a ZSU.[117]

Obviously, the battalion is most vulnerable to air attack after the companies have crossed the river but the ZSU's have not. If the air attack could be coordinated with artillery fire delivered approximately 400 meters deep on the Soviet side of the river, there would be increased opportunities for killing tanks. Under no circumstances should attack helicopters cross over to the enemy's side of the river where the concentration of ZSU's will be waiting, several in ambush positions.[118]

What are the vulnerabilities of the ZSU and how can they be exploited? The first, and most often neglected, vulnerability of the system is that while it is the best, if not the only, truly effective air defense weapon against attack helicopters, it is limited in number. Therefore, if it could be deliberately attacked as the first priority target, the Soviet air defenses would be severely weakened. For example, a tank regiment has 118 armored vehicles.[119] The only truly effective air defense against attack helicopters is the organic ZSU-23-4 battery which consists of only four ZSU's. Simply stated, killing one ZSU mount leaves nearly thirty armored vehicles of this unit without effective air defense against attack helicopters. The situation in the motorized rifle regiment is even more favorable to this tactic. Since there are 146 armored vehicles in this unit,[120] each of the four assigned ZSU's is defending, more than 36 armored vehicles. Naturally, small arms and SA-7's will remain to defend, but the primary threat will have been removed.

The silhouette of the ZSU is certainly another vulnerability. The vehicle is difficult to mistake in a column of BMP's or tanks. The prominant GUN DISH radar and the four barrel assembly allow it to be distinguished quickly in a column.

Curiously, the ZSU's greatest strength, its radar, can be used to the attack helicopter pilots advantage. The Soviets write very little concerning the effectiveness of this radar. One article describing the ZSU reports the following data: "Planes or helicopters flying over open country at an altitude of 100 meters can usually be detected at a distance of not more than 10-15km, whereas over a closed countryside, they can appear in the area of a target completely undetected."[121] The radar obviously cannot penetrate topographical features. Also, at very low altitudes, "ground clutter" will cause problems with the radar. Electronic warfare devices can be used to jam the ZSU radar. The potential is always there with any system of this type. As a radar tracker, the ZSU emits a unique signal, an electronic "signature". This can be used to identify and locate the unit. The on-board AN/APR-39 can be used to signal the ZSU's existence, proximity and general direction. The GUN DISH antenna of the

radar can be destroyed by artillery fragments, mortars, rockets, etc. Simply by destroying the radar capability of the ZSU, its capability to acquire and hit an aerial target drops considerably. Perhaps, if the Soviets quickly discover that the prolonged radar operation of a ZSU allows it to be detected and destroyed, they will be forced to turn it off, achieving the same result, a drop in effectiveness.

How effective is a ZSU without radar? The Soviets, in their recent articles, have provided some information here. One article describes the sequence involved in firing a ZSU in the optical mode. First, the target must be visually acquired, then the command given: "Target on the left, helicopter. Range 2,000 meters, Destroy!" The article describes how the operator must lay the tubes in the direction of the target by turning the handle of the control panel, shift the sight lever to the "doubler position", align the open sight with the axis of the bore, set the distance grid with the indicated range, bring it up under the target, and finally, press the button on the control lever to fire a short burst.[122] In this case, he missed. The senior sergeant made a correction for wind and range and ordered long bursts until the target was destroyed.[123] Obviously, the ZSU without radar is far slower. In this case a stationary target at 2,000 meters was missed the first time. The short burst would certainly have alerted the attack helicopter pilot.

Although the above sequence would appear to take quite some length of time to perform, the question "How long?" was not answered until the following article appeared in 1979: in a timed test without radar "the majority of the crews were slow, much time was wasted finding the targets, refining and using the fire data. The result of this is that they opened fire, as a rule, 2 minutes after the helicopters appear."[124]

At this point the commander took his best-trained crew and ordered them to fire as soon as possible. Otherwise, he says "the helicopters will have time to launch several ATGM's and drop down into concealment." The crew was lauded for opening fire in 32 seconds, "... without making a single mistake."[125]

How do these times compare with the launch of a TOW missile? The flight time of a TOW missile from 3,000 meters is approximately 14 seconds.[126] From 3,750 meters it is 21 seconds.[127] Therefore, a total exposure time for the aircraft is in the order of perhaps 15-25 seconds, if the pilot immediately remasks.[128] It is during this time period that the "average" ZSU crew must detect, acquire, fire at, and hit the attack helicopter. It is easy to see that the ZSU-23-4 is the only Soviet air defense weapon that comes close to matching this short period of time. Again, the importance of destroying or suppressing the ZSU radar is underscored.

To continue with vulnerabilities of the ZSU radar, it is clear from Soviet descriptions of the ZSU during exercises that it cannot prepare to engage one target while scanning for others.[129] Therefore, the concept of a decoy aircraft, say a "scout", to unmask and remask at approximately 3,500-4,000 meters range from a ZSU would allow an attack helicopter to strike undetected from a flank position.

If it can be hit, a ZSU can be destroyed. It is a comparatively "soft" target. The ZSU armor has a maximum thickness of 6.3 millimeters in the front of the crew compartment and 9.2 millimeters on the hull.[130] The T-54/55/64 Tanks, by comparison, have armor varying from three to six inches in thickness.[131] Not only can heavy machine gun fire penetrate the turret and hull, but its tread

and road wheels are subject to damage by artillery; and high-explosive fragments can penetrate its armor, destroy the radar dish and rupture the liquid coolant sleeves of the 23mm cannons.

Another vulnerability in a mid-intensity conflict could turn out to be the ZSU's high rate of fire. The amount of ammunition carried (1,300-2,500 rounds) and rate of fire (3,400-4,000 rounds/minute) has been confirmed in the Soviet press.[132] Simple mathematics will reveal that, at that rate of fire, with four barrels, the on-board ammunition supply will be exhausted in 45 seconds of continuous fire. Of course, the Soviets fire the weapon in short bursts,[133] but the total time of fire is short and resupply of ammunition is in ammunition trucks normally 1.5-2km's behind. Conceivably, in a prolonged air attack, the ZSU's could run out of ammunition.

Finally, the ZSU is an extremely complex piece of equipment. It could be expected that maintenance and training are problems and the Soviet press confirms that they are. How much of a problem is difficult to assess, but an enlightening panel discussion with three ZSU battery commanders appeared in the Soviet press in 1978. One of the problems mentioned was the difficulty in obtaining 23mm blank ammunition for training. It seemed to be a common problem. One officer mounted an AKM submachine on the ZSU as a simulator. They all complained that the soldiers were frequently using the wrong fuels and lubricants. A special problem discussed was the electrical connectors; they were often dirty or wet. It was decided that the officers themselves had to check these connectors.[134]

The purpose of this chapter has not been to dispute the reported effectivenes of the ZSU-23-4; rather, to present this "invulnerable" weapon in a clearer light. The weapon can be very effective and is, without a doubt, the most dangerous weapon facing the attack helicopter pilot. On the other hand, attacking a column of tanks or BMP's, not possessing ZSU protection, has been described by one senior aviation officer as "a piece of cake".[135] So far, this study would support that optimism.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The greatest advantage of a low-level air attack is that it requires an extremely rapid response on the part of air defense weapons. The preceding review of Soviet literature indicates clearly that the Soviet Army has only one weapon system which is capable of delivering accurate and lethal fire in times competitive with the launch of the COBRA TOW missile: the ZSU-23-4.

Soviet small arms are limited in many ways:

(a) they depend upon visual recognition and are optically sighted;
(b) the effective ranges of these weapons are only one-third that of the attack helicopter. An attack helicopter firing from greater than 1,000 meters should not be vulnerable to Soviet small arms fire;
(c) reaction times are much too slow due to the Soviet concept of strict control of massed fires and identification problems;
(d) there are indications that Soviet small arms tactics and training does not accurately appraise current attack helicopter procedures.

They expect helicopters to be higher, faster, and closer than they will be employed and will "lead" the aircraft by too great a distance;

(e) small arms are generally unavailable as antiaircraft weapons during movement and in the Soviet attack;

(f) in actual helicopter vs. tank combat (LAMSON 719), small arms were not effective against helicopters.

The SA-7 "Strela", as a defensive weapon against low-level helicopters, appears to be a totally ineffective system. Fortunately, it is clear from their press that the Soviet forces have not yet realized this fact:

(a) the weapon is slow to employ. It depends upon visual target acquisition, requires manual ranging by the operator, and there is a delay from firing initiation to missile launch;

(b) the SA-7 is only effective against receding targets;

(c) attack helicopters will be constantly flying at or below minimum lock-on altitudes. The weapon can be underflown;

(d) the weapon is generally unavailable during the march and in the attack;

(e) ammunition resupply, as the unit expends its missiles, is questionable;

(f) helicopters successfully countered this weapon in Vietnam with infrared suppression kits and by adopting low-level flight techniques;

(g) the currently developed Advanced Attack Helicopter (AH-64) is reportedly invulnerable to this weapon.

The ZSU-23-4, on the other hand, is a dangerous weapon which presents a real threat to the attack helicopter:

(a) it is an extremely quick-response air defense weapon. Best response time without radar detection or direction is reported by the Soviets to be 32 seconds. A first-rate crew, with radar, should be much quicker;

(b) it has a rapid rate of large caliber fire;

(c) it has an excellent radar for both detection and fire control and is often fired while on the move;

(d) the operators are trained to operate without radar when required and are aware that there are radar detectors installed in US Army aircraft;

(e) the weapon's range is very close to the maximum stand-off range of the attack helicopter;

(f) the weapon is frequently employed in exercises in "ambushes" and as a "roving gun";

(g) the weapon system will be employed with the first-echelon Soviet units. Unfortunately, it is just these units which the helicopter will be required to attack.

There are, however, vulnerabilities in the ZSU-23-4 system. These vulnerabilities must be exploited by the attack helicopter pilot and ground commander alike. The weapon must be suppressed and destroyed whenever possible:

(a) there are limited numbers of these weapons systems in comparison to the vehicles covered;

(b) the ZSU radar "signature" can be used to detect them and warn pilots;

(c) the GUN DISH radar antenna is vulnerable to artillery and small arms fire. The vehicle has thin armor and many vulnerable external parts. It can be effectively destroyed by artillery;

(d) the weapon can be deceived by a decoy aircraft while another aircraft attacks;
(e) the position of the ZSU mounts during a Soviet attack is known;
(f) ZSU's are not able to provide adequate air cover throughout a battalion river crossing operation;
(g) resupply of ammunition may be a problem for the ZSU in periods of intense combat;
(h) air launched weapons can be developed which will seek out the radar "signature" from the ZSU's antenna.[136]

In conclusion, there are vulnerabilities in both the philosophy and weapons systems of low-level air defense forces of the Soviet army. In the preceeding chapters, specific vulnerabilities have been exposed by a review of the Soviet open press and specific recommendations have been presented. It is hoped that work will be continued in this area, not simply to discover air defense vulnerabilities, but to ensure that this type of information is readily available to attack helicopter crews. In spite of what is known in the West, and what is available in Soviet press, much is still classified or simply unknown.

There is, however, one conclusion which must again be stressed in closing. Current US tactics do not separate the destruction or suppression of Soviet air defenses from degrading enemy combat power per se (i.e., killing tanks). In initial engagements, killing tanks in column with a ZSU is equivalent to drawing on a gun-slinger's horse. The first target is the "gun-slinger" (ZSU), then all the "horses" are vulnerable. Presently, US attack helicopter tests and evaluations tend to teach the wrong lessons. Each pilot and his commander is concerned with the final tank vs. helicopter ratio. That is the number that will be carved in granite at the close of the exercise. Will it be 12:1 or better? What is missing is a credit factor for ZSU kills. One ZSU should be worth at least 10 tanks in exercise play; they will be worth far more on the battlefield. Also, nearly all tests are computed on repetitions of "first" exchanges of fire or simulations in which the ZSU's cannot be destroyed. If kill ratios are to be meaningful and predictive, second and third engagements should be considered, after the ZSU's have been destroyed. The resulting kill ratios would be spectacular.

Larger helicopter units should be used in antiarmor attacks. The standard "one scout/two gunships" tactic allows the enemy to concentrate their attention and fire on a few targets. Tests should be conducted with attack helicopter companies supporting brigades and destroying the ZSU's as first priority. Again the results would be startling.

Finally, on the battlefield, in cases when the ZSU's of a unit have been destroyed, whether by air or ground forces, those units must be considered high priority targets for future air activity, both by TAC air and helicopters. They must be tracked and destroyed.

Clearly, the air defense battle is a battle of attrition. The winner and loser will be determined by who runs out first. The employment of attack helicopters should be viewed in this light. If attack helicopters achieve a 12:1 kill ratio against tanks but all are destroyed in the process, there will still be tanks--and stopping them will be far more difficult.

Perhaps the US Army should review the lessons of the last great air defense battle of the Vietnam war. In December 1972, B-52 attacks on military targets surrounding Hanoi involved about 1,000 sorties in eleven days. The North Vietnamese countered with SA-2 missiles, firing as many as 100 at a time.

US electronic counter-measures were saturated by these massed attacks and B-52 losses peaked at six on the third and fourth days. At this point, the Air Force changed tactics and struck the SAM and radar sites with fighter-bombers and air defense suppression F-4's. By the fifth day, no B-52's were lost. The battle of attrition was won; NVA radars could no longer track targets, and the B-52's "flew at will".[137] Soviet sources clearly indicate that the ZSU-23-4 is the attack helicopter's "SA-2". If these can be suppressed and destroyed, perhaps the attack helicopters can "fly at will" in less than eleven days.

FOOTNOTES

[1]General Hamilton H. Howze, "The Case for the Attack Helicopter", Army, (March 1979), p.18.

[2]Ibid., p.19.

[3]Fredrich Wiener and William J. Lewis, The Warsaw Pact Armies, (Vienna: Carl Ueberreuter Publishers, 1977), pp.234-237.

[4]Voyennyy Vestnik is the most widely circulated Soviet military journal. It is a monthly publication which deals mainly with tactics and training below regimental level.

[5]Colonel V. Trishin, "Vmeste s Tankistami", Voyennyy Vestnik, No. 8 (1979), p.67.

[6]Colonel General M. Zaytsev, "Organizatsiya PVO--Vazhnaya Zadacha Obshchevoyskovogo Komandira", Voyennyy Vestnik, No. 2 (1979), p.23.

[7]Colonel I. Chebotarev, "Vertolet protiv Tanka", Aviatsiya i Kosmonavtika, No. 10 (1977), pp.46-47.

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