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SOVIET ASSESSMENTS OF U.S. CLOSE AIR SUPPORT

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Dan Shephard

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1. INTRODUCTION

This report has two fundamental objectives. The first is to provide documentation and analysis of Soviet military assessments of U.S. close air support (CAS) weaponry. The second is to examine the relationship between the American CAS technologies and Soviet near-term and long-term reactions as a basis for predicting future Soviet responses to U.S. weapons innovation.

With reference to objective number one, an essential component of the report will be an attempt to document the particular elements that the Soviet military focused on in their discussions of U.S. CAS technology, i.e. the specific technical and performance characteristics that were emphasized in Soviet writings. Of particular interest is whether their assessments differed dramatically from comparable U.S. discussions of CAS technology. An even more fundamental question that arises: What purposes do Soviet assessments appear to serve? In the close air support case, one function clearly seems to be the distribution of data on the current state of the adversary's technology to the general military readership, as well as identify potential threats that may be products of that technology. Beyond these purposes, however, remains the question: What are the more abstruse motivations for disseminating this information through the military press? Some past cases seem to indicate that assessments of foreign technological programs act as surrogates for discussions of present or future Soviet technology programs, or allow writers to tendentiously construct assessments of U.S. weapon systems in order to

promulgate a particular point of view. One intent of this report is to identify these more recondite purposes behind the Soviet descriptions and evaluations of U.S. CAS technology.

An additional intent is to look at Soviet force planning, training, and tactics for insights into Soviet response mechanisms to U.S. weapon innovation. Too often, it seems, the Soviet process of reaction to developments in Western military technology is assumed to follow along the lines of past U.S. responses that directed all resources towards technologically duplicating the threat (e.g. Sputnik, the first ICBM). Recent research indicates that this is not a very satisfactory portrayal of Soviet reactions, and it will be argued here that the Soviets respond in a predictable manner when confronted with a challenge of a technical nature -- responses which adhere to the following general pattern:

1. Identification of the Problem;
2. Call-To-Action at the operational (non-technical) level;
3. Near-term alterations of existing technology (Design Innovation);
4. Development of new equipment (Technological Innovation).

The main point to remember from this list is that the Soviets tend to react to U.S. weapon threats with a highly diversified approach of which countervailing technologies are only a part. A better understanding of this Soviet style of threat response should help to improve the military payoff of American technological innovations.

1.1 Sources

This report has relied extensively on the various military journals available in the open Soviet press, as well as the one restricted Soviet journal available, Military Thought. The open publications in both English and Russian include the Ground Forces periodicals: Voyennyy vestnik (Military Herald) and Znamenosets (Standard-Bearer); the Air Defense organ: Vestnik protivovozdushnoy oborony (PVO Herald); the Air Force journal: Aviatsiya i kosmonavtika (Aviation and Cosmonautics); and the more general periodicals and newspapers including Krasnaya zvezda (Red Star), Tekhnika i vooruzheniye (Technology and Armaments), Soviet Military Review, and others. In all cases where the original text was used the journal will be identified by its Russian title; when translations were consulted, the English title will appear. Several books were consulted but none proved to be particularly useful, they generally being out-of-date and devoid of technical data.

2. CLOSE AIR SUPPORT

2.1 Introduction

The essence of tactical close air support warfare has changed enormously in the last 15 years. In 1970, most U.S. air-ground operations still consisted of aging fixed-wing aircraft dropping unguided bombs. By 1975, remote controlled missiles had arrived along with guidance systems utilizing TV and radar tracking, and Nap-Of-the-Earth (NOE) flying helicopters had proven to be very effective CAS delivery vehicles. By 1980, lasers and infrared technologies were being widely used and for the first time the United States had deployed a fixed-wing attack aircraft, the A-10, that was designed specifically for close air support operations against tanks and other moving objects.

Throughout this period, Soviet analysts were assessing these CAS developments with interest and, frequently, concern. Within the delivery aircraft domain, a sizeable gap occurred between attention paid to helicopters and that given to fixed-wing aircraft, with the number of articles running at 6:1 in the rotorcraft's favor (See Table 1). This discrepancy is significant enough for further examination to be warranted, which will be attempted on the pages that follow. Other issues to be looked at in this section will be Soviet assessments of helicopter anti-tank capabilities, stand-off capacity, and joint A-10/helicopter operations, in the overall pursuit of chronicling Soviet interpretations and outlook on U.S. CAS delivery aircraft of the past 15 years.

TABLE 1

Number of Articles on Helicopters and Fixed-Wing Aircraft:

	Fixed-Wing	Helicopters
197[illegible]	0	2
197[illegible]:	2	5
197[illegible]:	3	3
1973:	0	2
1974:	0	8
1975:	0	13
1976:	0	9
1977:	0	8
1978:	1	4
1979:	0	5
1980:	0	5
1981:	1	6
1982:	2	5
1983:	1	4
1984:	2	5
TOTAL:	12	84

2.2 Helicopter Development

Helicopter designs have been around for quite a long time. Toy helicopters are displayed in Chinese drawings from the Seventh Century A.D., and were mass-produced in Europe more than 500 years ago. However it was not until 1939, 36 years after Kitty Hawk, and more than a thousand years since the first known drawings of helicopters, that Igor Sikorsky's US-300 made the first successful flight by a rotary-winged aircraft. Not long after Sikorsky's historic achievement, helicopters entered series production, and soon after that the concept of arming helicopters began to take shape. The Germans were the first to act upon this idea. By late 1944, the Fa-223 Drache, a medium-sized military transport helicopter was fitted with a single Rheinmetall MG-15 machine gun mounted in the nose.[1]

In spite of the German deployment, for a long time it seemed doubtful that the helicopter would ever make a suitable weapons platform. Helicopters were inherently unstable, with the vibration levels making accurate firing a dubious proposition, and the weapons themselves were usually too heavy and awkward for the delicate qualities of the early rotorcraft. In light of these problems, efforts at arming helicopters did not really bring much success until the French CH-21 and Alouette II with mounted machine guns and cannon proved to be effective in the Algerian campaigns.[2] French success energized American research, and by 1962 the U.S. Army had sent into Vietnam combat UH-1As and 1Bs with two 7.62 mm M-60 machine guns, each firing 600 rounds per minute. To its dismay, however, the Army soon found that with any weapon load the UH-1B was quite unable to carry troops or cargo; its maneuverability suffered and its

speed was so reduced that if it ever left a formation to attack a target it could not catch up again.[3] Armed helicopters needed better protection, greater speed, and yet heavier firepower. These extensive requirements induced research efforts that mainly succeeded in developing a costly morass of sophisticated technologies that collectively bore the title "Advanced Aerial Fire Support System" (AAFSS).[4] This project endeavored to produce a helicopter christened the AH-56 Cheyenne, but because the excessive complexities engendered enormous costs and frequent delays, the entire project was finally cancelled. As a consequence it was decided that an amalgam of existing systems was the best near-term solution, and the hybrid helicopter produced was the AH-1G Cobra, an aircraft whose accuracy was sufficient only for area targets or suppressive fire.[5]

Developments were also taking place in helicopter-based anti-tank missiles. Although it was not until 1972 that TOW (Tube-launched Optically sighted Wire-guided) missiles launched from helicopters were deployed in Vietnam, much research and public discussion had been taking place since 1968 on the feasibility of such a configuration.[6] The missile guidance system known as MACLOS (Manual-Command-to-Line-Of-Sight) was very difficult to operate even under ideal conditions. Nonetheless, the possibility of MACLOS-guided TOW missiles launched from Huey Cobras or AH-56 Cheyennes was the weapons combination most referred to in the early Soviet evaluations of U.S. helicopters as attack vehicles.

2.2.1 Soviet Assessments of U.S. Helicopters: 1965-78 Development of "air-based artillery" was also proceeding in the Soviet Union, and by the late 1960s Mi-4s and Mi-6s had 12.7 mm machine guns emplaced under the

nose.[7] Accompanying advances in Soviet helicopter performance was an increased interest in the Soviet military press of U.S. capabilities in this area. While Soviet articles on the use of helicopters in combat appeared as early as 1965,[8] and articles in 1967 and 1969 reported that U.S. helicopters were being fitted with anti-tank weaponry (principally TOWs), the first Soviet press article to really discuss helicopters in the role of a fully-armed battlefield weapon appeared in the August 1971 issue of Military Thought. A curious aspect of this article is that it was a reprint of a work written by an East German doctoral candidate, I. Weinhold, that was first published in the GDR military journal, Militarwesen. Weinhold began by declaring there could be no doubt that armed helicopters had "appreciably changed the principles of modern warfare."[9] Use of helicopters, Weinhold noted, had made it possible to deliver fire on targets as close as 30 meters from friendly subunits.[10] Weinhold also discussed the use of helicopters in airmobile operations, where troops and even artillery crews are transported with their weapons to positions behind the Forward Edge of the Battle (FEBA) line.[11] The AH-56 Cheyenne was singled out for special praise for its diversified weapons arsenal and excellent flight characteristics, and armor plating for protection against small arms fire.[12] (To Weinhold's probable chagrin, the Cheyenne was cancelled soon after this article was published). However, the most interesting capability that was ascribed to U.S. combat helicopters was their capacity for carrying out "tactical nuclear strikes". According to Weinhold, the principal objective behind a helicopter-launched nuclear strike would be the "intensification of

pressure on enemy forces and the speeding of troop penetration through enemy lines."[13]

It seems safe to assume that Weinhold's statement on the possible use of helicopters as delivery vehicles for nuclear weapons was something of an aberration. To the best of our knowledge, no other piece of writing that has appeared in the Soviet press in the last 15 years has corroborated Weinhold's assertion. Soviet analysts have long considered that anti-tank operations were the principal function of armed helicopters, not the firing of nuclear weapons. Indeed, it is difficult to imagine under what circumstances a helicopter would be chosen over a fixed-wing aircraft for the task of delivering even a low-level nuclear strike.

Weinhold's article was the first to concentrate on the possibilities of helicopters in a fire-support or anti-tank role. In the October 1971 issue of Military Thought, I. Andrukhov became the first Soviet bloc analyst to focus exclusively on the direction the U.S. was moving in the employment of helicopters. Andrukhov maintained that the U.S. helicopter industry had found solutions to a number of technical problems that had long confounded designers, including the development of a suitable lightweight powerplant, and the elimination of vibrations, along with the production of less complicated designs that made the helicopter much easier to operate.[14] Andrukhov appears to have been referring primarily to some of the advances that had been incorporated into the AH-56 Cheyenne. His assessments conflict sharply with the prevailing American views on the Cheyenne, which became sufficiently disappointed with the system to have it cancelled. Some Western analysts, in fact, did not seem

at all clear on what exactly could be done with the helicopter on a European battlefield.[15] Even 0.5 inch caliber machine guns in Vietnam had demonstrated a knack for downing helicopters, and the problem of maintenance in a hostile environment was one which did not appear to have any clear solutions. While some experts had expressed optimism that the new breed of armed helicopters could be made suitable for European anti-tank missions, the general perception was that nothing too dramatic could be expected from helicopters, as they were too unstable to fire accurately and their survival rate would be quite low.[16] Some even suggested that it would be difficult to find crews for combat helicopters as their extreme vulnerability would engender severe morale problems.[17]

As for the Soviets, Andrukhov's article and articles by Soviets such as Botin[18] and Semenov[19] were typical of several analyses of the helicopter threat made by Soviet experts during the 1970-73 period. These reports, coming at a time when the armed helicopter was still a relatively recent phenomenon, were characterized by their non-thematic approach in examining the weapon. The general attitude appeared to be one of uncertainty as to how and where the U.S. helicopter would be employed, and the articles reflected this by giving broad descriptions of helicopter capabilities that emphasized a multi-role capacity for U.S. helicopters that really did not exist at the time. It was not, in fact, until the latter part of 1973 that Soviet writings narrowed in on one particular portion of the helicopter's combat repertoire: The ambush or "pop-up" anti-tank role.

Lieutenant-General V. Gatsolayev was the first in the Soviet press to chronicle western surprise attack techniques. Writing in the November

1973 edition of Military Herald, Gatsolayev began by listing the reasons why Soviet Ground Forces and air defenses had much greater reason to be concerned about helicopters than they did fixed-wing aircraft. He cited their ability to change flight altitude and speed very quickly, a cargo-carrying capacity that enabled them to carry various types of guns and instruments, the fact that helicopters did not require costly and vulnerable airfields, and, most importantly, that they were much more effective against small, mobile targets than their fixed-wing counterparts.[20]

Gatsolayev then described the manner in which helicopters could suddenly bore in on tank columns and cause havoc for an Army moving rapidly on the offensive. He noted that Soviet ground forces could expect a U.S. anti-tank helicopter to cruise in at low altitude, using any cover available. After sighting in from a hover position, the helicopter would move in and fire off one or two anti-tank missiles, then rapidly egress from the zone of combat in an attack that shouldn't last longer than 10-15 seconds.[21]

Western sources generally envisioned a different scenario for helicopter attacks at this time, the advantages of pop-up techniques not being generally appreciated yet. As many Western analysts saw it, helicopter fire strikes would be most effectively employed while enemy armored columns were moving to deployment lines or forming into combat formations.[22] In these situations, it was estimated that the density of armored targets would reach their maximum. U.S. helicopters would then employ an integrated strike with the launch of TOW anti-tank guided missiles against individual targets and massed firings of unguided

missiles against area targets.[23] The downside to this strategy was that the helicopters were largely devoid of concealment and in a European war could be expected to have a very high mortality rate.[24] During a 1971 Senate Armed Services Committee Hearings on close air support, Deputy Secretary of Defense David Packard stated: "If the helicopter can identify and fire on the target within a few seconds then there is some chance for survival. If he cannot the chances for survival are very slim."[25] This point of view was buttressed in 1973 by Israeli Major-General Peled, who told a visiting U.S. congressional committee that "in the daytime, the helicopter simply has no right to exist."[26] The pronounced lack of symmetry here between Western and Soviet versions on the optimal employment of helicopters is a good example of how Soviet assessments of U.S. technology are often entirely independent of the views and information that is being disseminated in the West. Pop-up techniques got almost no favorable attention in the West before 1974; it was not until almost a year later that Western reports began to correspond with the version of the helicopter's potential use that the Soviets had been attesting to for some time.

In early 1974, an important article by Mikhail Belov, the most prolific Soviet expert on helicopters, appeared in the February issue of Military Herald.[27] The significance of Belov's composition can be found in the following statement: "rocket fire from helicopters now poses the greatest threat to armored units that exists on the modern battlefield. . . Against the tank, they helicopters possess decisive superiority in field of view, speed, maneuverability, and range of fire."[28] Belov's account appeared to act as a catalyst for many 1974 and 1975 articles on the

helicopter-based threat. As might be expected, the different authors emphasized a variety of responsive actions which will be addressed in more detail in the calls-to-action section of this report. The general categories of reactions, however, can be delineated into the following areas: re-deployment, reconnaissance, re-application of existing weaponry, and technological innovation.

As Table 1 shows, Soviet intensity of interest in U.S. helicopters declined dramatically in 1976. In retrospect, the decline appeared to reflect Soviet design innovations that served to ameliorate previous concerns. The introductions of the SA-8 and 9 added to the earlier improvements in the ZSU-23-4 and SA-7 provided an overlapping network of AA guns and missiles that appeared to considerably reduce Soviet anxiety over the American helicopter threat. Thus while Soviet confidence in their tactical air defenses increased, a pronounced decline in attention paid to helicopters resulted. This trend did not truly reverse itself until 1979, when Western advances in stand-off technology became a major topic of concern.

2.2.2 The Attack Helicopter: 1979-1984 Western countries had not remained in a state of torpor while the Soviets were introducing effective defensive measures. U.S. tacticians understood that even helicopters using "pop-up" tactics would be exposed to a severe threat from the Soviet's air defense system. Accordingly, efforts were directed at increasing helicopter survivability, with technological innovations falling principally in the areas of night-vision systems and stand-off technology. The night-vision avionics came under the general rubric of

PNVS (Pilot Night-Vision System), with sub-systems including FLIR (Forward-Looking Infra-Red System), and LDNS (Lightweight Doppler Navigation System).[29] Soviet analysts during this period expected western efforts to reduce helicopter vulnerability to be in three principal areas: 1) The decrease in probability of helicopter detection in the air; 2) An increase in the resistance of its structural design to the destructive effects of ground fire; and 3) The extension of the range of anti-tank guided missiles and their guidance systems in order to remove the attack helicopter from the reach of most ground-based air defenses, i.e. a stand-off capability. V. Alekseyenko in a 1981 Tekhnika i vooruzheniye article suspected that American research would move in the direction of greater concern for the suppression of the infrared radiation of the engines.[30] The hot parts and gas jets of jet engines are sources of heat and can be detected by infrared sensors of antiaircraft complexes. Alekseyenko also wrote that the U.S. was working on special panels that would limit the emitted radiation to a narrow spatial beam, and decrease the exhaust jet temperature as a result of the ejection of an additional amount of cool air.[31] He further predicted that future U.S. helicopters would have a fuselage with a "narrow, low silhouette, the skin covered with radio-absorbing material, and the blades made of fiberglass; making the surface of the helicopter as convex as possible."[32] In large part, these projections proved correct, as the U.S. did turn to IR-suppressing engine exhausts,[33] and future helicopters did have much narrower silhouettes.[34]

Other Soviet analysts predicted that the next generation of U.S. helicopters would have much greater attention given to the invulnerability

of the flight control system. In a 1979 article in Zarubezhnoye voyennoye obozreniye, N. Shishov said that a key goal would be the separation of redundant components so they wouldn't be simultaneously destroyed, as well as using special materials of "fibrous structures" (graphite fiber perhaps?) in the design of tightly loaded mechanical linkages (arms, pullrods, cranks), which could easily take penetration by small shrapnel and be rendered inoperable.[35] A further concern was said to be the vulnerability of the hydraulic system and the possibility of fire should it be hit. Shishov laid out in detail a possible U.S. plan where the service lines of the hydraulic system would be simplified by developing a unified power drive consisting of the power drive itself -- an electric motor and a hydraulic pump.[36] This would be augmented by the creation of "logic units" that would automatically disconnect damaged elements of the hydraulic system.[37]

In addition to the minimization of detection and reduction of structural design vulnerabilities, the third area in which the Soviets expected to see U.S. helicopter advances was in stand-off technology. Soviet tacticians were (and are) in general agreement that a paramount weakness in the Soviet air defense system is its assailability to stand-off weaponry. A 1980 article by G. Kibardin in Aviatsiya i kosmonavtika pointed out the tremendous strides the U.S. was making with systems such as the Hellfire missile and laser/IR guidance, and how the helicopter was perfectly suited for the stand-off role because -- unlike fixed-wing aircraft -- it could hover indefinitely over friendly territory, launching missiles across the FEBA with little fear of retaliation.[38] The principal aircraft expected to perform this stand-off

role was the AH-64 Apache, the first U.S. design employed exclusively as an attack helicopter (the ill-fated AH-56 Cheyenne was configured for attack operations but never got past the testing stage). The Apache has been of particular concern to the Soviets because it is the only helicopter in the world (with the possible exception of the Mi-24D) capable of operating at night over a high-intensity battlefield. Apache is able to accomplish this primarily because of FLIR (Forward-Looking Infra-Red System) which Soviet analyst R. Kluyev wrote "provides a complete scanning as well as aiming capability for night action."[39] On the negative side, notes Kluyev, FLIR's picture definition is thought to be poor, inadequate at distances greater than 6 km.[40] In addition to the attack of ground targets, the Soviets envisioned that the AH-64 would be used for stand-off missions such as ELINT, noise and smart jamming of air defense radar, and disrupting Soviet field communications with special HF/UHF jamming.[41] This assertion was interesting because there does not seem to have been any corollary mention in Western publications of the Apache being planned for these purposes. Most American reports have said these operations would be handled by the UH-60.[42] So far, the AH-64 has not been employed for any of these jamming or reconnaissance missions.[43]

That the Soviet military would eventually have to start looking for a satisfactory alternative to ground-based anti-helicopter defenses seemed almost a foregone conclusion as U.S. stand-off capacity progressed in the 70s and 80s. Even as far back as 1976, Lieutenant General M. Reznichenko wrote in Krasnaya zvezda: "The correlation between tank and helicopter losses is projected to be 12:1 or even 19:1 in the helicopter's favor, according to practical experiments. This imbalance will continue to widen

as helicopters become more and more capable of hitting armored targets while remaining out of reach of antiaircraft weapons."[44] In 1979 M. Belov observed that the "problems of dealing with helicopters had become more complicated than ever, that at distances of over four km helicopters are practically invulnerable to ground antiaircraft weapons."[45] The realization was taking hold that for a defense against helicopters to be effective, it would also have to be airborne. Tactical fighters however, were considered to be ill-suited for an anti-helicopter role because of their comparatively poor maneuverability. That left but one remaining possibility, and appropriately, it was Colonel Belov who became the first to publicly state that the time had come where helicopters had to be countered with the only weapon which could match the helicopter in maneuverability and firepower -- another helicopter.[46]

That helicopter air-to-air engagements will eventually be a part of the contemporary battlefield scene, there can be little doubt. U.S. sources report that more U.S. rotorcraft are being fielded with lethal, long-range, wide aspect missile and gun systems.[47] The 1984 American Helicopter Society Proceedings reported that the simple strap-on installations of past helicopter systems will be inadequate in countering the guided missiles and rockets of Soviet 'killer' helicopters.[48] Ironically, as the current development of helicopter technology continues at a breakneck pace, the human responsibilities are increasing almost as fast, to the point where crew workload could easily become an important factor in air combat performance. The contemporary attack helicopter pilot will have to fly at "Nap-Of-the-Earth" (NOE) altitudes at high speeds while having to deal with terrain, weather, visibility, ground

defenses, and soon, marauding 'killer' helicopters with equal maneuverability and greater air-to-air firepower.

As for Soviet strategists, its been clear to them since 1980 that the U.S. is preparing for helicopter aerial combat. In 1980, V. Chernyukin wrote in Aviatsiya i kosmonavtika that the U.S. was arming its attack helicopter fleet with 25 mm rapid-fire cannon weaponry "for the express purpose of attacking helicopters supporting tanks."[49] Two months earlier, Zarubezhnoye voyennoye obozreniye had published an article by V. Nelin on the "Multipurpose Missile System" (MPMS). Nelin noted that the MPMS was an air-to-air "anti-helicopter" guided missile which was an amalgam of the Stinger surface-to-air missile and a POST (Passive Optical Seeker Technique) homing head, that could operate in the IR spectrum band and possessed increased resistance to interference.[50] From the Soviet perspective, the significance of the U.S. deploying air-to-air weaponry was that the U.S. now recognized that tactical warfare was entering a new stage; an era where attack helicopters must not only be prepared for battle with ground defenses, but with aerial combatants as well. The fabled dogfight, this time with helicopters as the combatants, was making a comeback.

2.4 Fixed-Wing Aircraft

Use of fixed-wing aircraft over the battlefield began in World War I with their application as observation platforms. Aircraft were then crude and light and could not carry much payload; their roles as attack weapons were therefore of no great importance. During and following World War II, however, tactical aircraft had a great impact as deliverers of massed

firepower on troops in the field. In Vietnam, for example, the Viet Cong and North Vietnamese tended to break off a battle when American or South Vietnamese forces received direct air support.[51] Vietnam, in fact, provided many insights into the nature of modern tactical air operations, and one of the most interesting was that high-performance jet aircraft were not necessarily the best ground attack weapons. It was found, for example, that older piston-engined planes like the A-1 Skyraider and AT-28 were surprisingly effective[52] -- information which proved to be useful during the Air Force's 1970s search for the optimal close air support design.

In 1967, after years of study and debate, the U.S. Air Force initiated the A-X program for a genuine close air-support aircraft. The U.S. had never had such an aircraft, these missions having previously been flown by fighters such as the F-105 and F-4.[53] The lessons learned in Vietnam and elsewhere led to emphasis in the A-X program being placed not on speed but on lethality against surface targets (especially tanks), survivability against ground fire, a heavy weapon load and long mission endurance. In a lengthy competition the Northrop A-9A and Fairchild A-10A were pitted against each other in flyoff contests throughout 1972, after which (to the Soviet's surprise) the A-10 was announced as the Air Force's choice in January 1974.[54]

2.3.1 Soviet Assessments The most striking feature about Soviet assessments of U.S. CAS fixed-wing aircraft since 1970 has been their scarcity, particularly in comparison with the lavish attention that has been given to helicopters in Soviet journals. Part of the explanation, of

course, is connected to the disparities in doctrine and operational objectives that existed (and still exists) between U.S. and Soviet planners. USAF tactical doctrine had long stressed offensive action and the ability to respond to crises and armed conflicts with "rapidity", and with a wide range of options available.[55] For U.S. tacticians in the '70s, helicopters were deficient in two important categories: They were slow-moving aircraft and could not go anywhere with much rapidity, and they carried a smaller weapons payload than fixed-wing fighters, which reduced the range of options as to how and where helicopters could be utilized. Soviet tactical concepts, on the other hand, have always been tightly bound to the aspirations of the ground forces, and thus their doctrinal concepts for tactical air forces generally focus on the near battlefield. The Soviets had never had much of a need for aircraft with multi-purpose payload combinations, and so when they assessed U.S. attack helicopters from within their framework, there seemed to be quite a lot the helicopter could do. Helicopters could take off and land without requiring fixed, easily-bombed airfields; they were less vulnerable to antiaircraft fire, and most significantly, they were better than just about any other weapon around at stopping tanks -- the soul of the Soviet offensive.

The first Soviet reference to U.S. fixed-wing CAS aircraft was after the early rounds of the 1972 A-9/A-10 fly-off competition. Yu. Grobev in a 1972 issue of Aviatsiya i kosmonavtika was particularly impressed with the A-9's maneuverability, which he attributed to the aircraft's Side Force Control system.[56] V. Deryabin in a 1973 PVO Herald article also stressed the good maneuverability, as well as good vision and superior

armor-plating of the A-9.[57] In general, both articles evinced a partiality towards the A-9, and it is thus interesting to compare the official American positions for choosing the A-10 over the A-9 with the published Soviet assessments. The principal reasons given for the U.S. preference for the A-10 were the plane's "responsiveness and simplicity."[58] By "responsiveness" it was meant that the A-10 was better equipped to perform a multitude of ground support missions, in particular the provision of immediate support to ground forces in hostile free-fire zones. Additionally, the A-10 was lauded for its "simplicity", a quality which was expected to engender a high sortie rate and good maintenance record. The unstated factor, of course, was cost. The Northrop A-9 was priced at several million dollars more per copy than the Fairchild A-10. In contrast then, while Soviet analysts appeared to concentrate on the survivability and superior avionics as their criteria for preferring the A-9, U.S. planners saw versatility and economic factors as the attributes most desired in a ground-attack aircraft. The final twist to this episode is that when the first Soviet aircraft specially designed for CAS operations was introduced, the SU-25, it bore a striking resemblance not to the A-10, but the A-9.[59]

After the January 1973 decision was announced in favor of the A-10, the topic of U.S. fixed-wing CAS aircraft all but disappeared from the pages of Soviet military journals for the remainder of the 1970s. The lone exception was a 1978 article in Zarubezhnoye voyennoye obozreniye on the A-10.[60] The article, by Captains V. Antonov and A. Karylin, noted the A-10's heavy armor and impressive array of ASM weaponry, but also listed a long litany of A-10 deficiencies; including difficulties at low altitudes,

the inability to operate in bad weather and at night, and an over-burdening of the pilot with piloting concerns that hinders target search and destruction.[61] U.S. publications have stated that the A-10s should carry the full range of air-to-ground ordinance, i.e., iron bombs and cluster munitions that would necessitate flying over the target, an idea not terribly popular with A-10 pilots, who felt that their survivability depended upon standoff weapons.[62] In contrast, the Soviet attitude seemed to be: What use is the A-10 if modern air defenses have taken away the principal mission it was designed for -- low-altitude over-the-target ground attacks? Add to this the fact that the stand off mission is more effectively performed by helicopters, and the Soviets apparent lack of interest in the A-10 during the 70s becomes easier to understand.

The 1980s have seen some Soviet interest in the A-10 emerge. Predictably, it is the aircraft's collaborative operations with helicopters that has been the object of attention. A 1982 Zarubezhnoye voyennoye obozreniye article reported that "the American Command feels that combined attacks of A-10s and Cobra-TOWs are four or five times more effective than if employed separately."[63] G. Osipov wrote that combat on A-10/helicopter joint missions involved "three discrete echelons."[64] The first included reconnaissance helicopters that would perform target indication functions. A small number of attack helicopters would be used as well to annihilate "discovered" targets. The second echelon would be made up entirely of attack helicopters that would launch from a "standoff position" of about 4 km. The final echelon would include helicopter gunships and A-10s, that would attack tanks, combat vehicles and armored

personnel carriers (APCs); the helicopters from an altitude of 8-20 meters, the A-10s from 90 to 200 meters.[65] This version differed somewhat from the standard U.S. version, which had the third echelon made up solely of A-10s.[66] A variation of the Osipov scenario was outlined by Colonel Yu. Kartenichev in January 1982 (Zarubezhnoye voyennoye obozreniye), in which the A-10 approaches the SAM missile launcher area at an altitude out of reach of antiaircraft missile systems, and the pilot then executes a shallow dive and closes towards the target.[67] As the SAM complex fires at the A-10, a helicopter determines the location of the complex, informs the A-10 pilot of the SAM launch, the launcher then coordinates, and both the helicopter and the A-10 fire at the launcher; the A-10 pilot doing so while vigorously trying to evade the oncoming SAM.[68]

Throughout the 1970s, the A-10 was all but ignored by the Soviet military press. A moderate amount of interest seems to have arisen in the 1980s, however, based on the perception that the A-10, working in tandem with helicopters, can be a survivable, and quite lethal, ground attack weapon. It remains to be seen if this new attitude will last. But if the several recent articles are any indication, the Soviets are at least starting to pay attention.

3. CALLS-TO-ACTION

As noted earlier, the threats posed by helicopters and stand-off technology are the areas which have captured the greatest amount of Soviet attention in the tactical air-CAS genre. Predictably, suggestions of response (calls-to-action) in this area have primarily been directed at neutralizing helicopters and other delivery aircraft, rather than the more daunting task of repulsing air-to-surface-missiles in flight. Prior research in this area has shown that Soviet patterns of response have tended to follow a fairly predictable course: The initial effort generally involves new training procedures, troop and weapon redeployments, and the re-application of existing technologies, i.e. measures which can be acted upon immediately to reduce the severity of the threat as much as possible. The second level of response is the redesign of existing weapon systems, a stage that generally involves a lag time of months to several years as "off the shelf" technology is adapted and reconfigured to meet the new threat. Finally, there is the long-term response, the technological innovation stage, out of which new Soviet technology is introduced. The essential point to be remembered here is that the Soviet pattern of response to U.S. technological development has been to combine weapons innovation with tactical and organizational changes.

The Soviet responses to the development of U.S. CAS technology has evolved in a manner that has conformed rather closely to the model outlined above. This has been especially true for Soviet responses to

U.S. advances in air-based anti-tank operations in the 1970s, and stand-off technology during the 1980s.

3.1 Soviet Response to Anti-Tank Helicopters: 1970-1978

During the years 1970 and 1971, the Soviet reaction to the U.S. use of fire-support helicopters in Vietnam might be characterized as a period of "threat recognition"; the first tentative steps were taken towards grappling with the developing menace. Soviet analysts in their writings frequently conveyed a sense of uncertainty and confusion about the capabilities of the attack helicopter, and the potential threat which it posed. Part of this was the result of U.S. helicopters having been operating in an environment and performing missions far different from what they would face in Central Europe, and it was not initially clear to Soviet tacticians whether the helicopter would be as effective an air-to-ground weapon system in a European context as it had been in Vietnam. As a result, Soviet articles on helicopters written in the early 1970s did not contain specific calls-to-action, primarily because the "threat" helicopters presented had not been fully defined, thus limiting open consideration of counter-measures. Even as late as November 1973, passages such as the following from Lt. Gen. V. Gatsolayev would appear in the Soviet press stating there was "still insufficient experience available on the combat employment of helicopters . . . thus it is difficult to reliably predict the types of operations that they will carry out in battle".[69] Ironically, after stating that there was still too little information on helicopters to be able to predict how severe a threat they would be, Gatsolayev concluded his article by proposing new training procedures in which troops would be taught new rules for visual

observation and trained to identify battlefield situations where pop-up attacks from enemy helicopters are likely.[70] Thus one can see that, even within individual articles, there existed a somewhat schizophrenic attitude towards the attack helicopter's potential. On the one hand, skepticism remained as to whether the helicopter could be sufficiently stabilized for accurate weapons-fire in a European war. At the same time, U.S. helicopters' performance had been impressive enough in Vietnam to warrant calls for new air defense arrangements and training methods.

The inaugural Soviet call-to-action against attack helicopters actually came in January of 1972, in the restricted officer's publication, Military Thought.[71] That Military Thought was the first Soviet military organ to pursue this question is not surprising, since writers in the lesser journals would frequently take their cues from "catalyst" articles in the restricted journal. The author of the 1972 article, Major General M. Botin, in noting the increased effectiveness of U.S. low-altitude offensive air activities,[72] called for increased mobility of air defense forces in protecting the main attack forces, and to be capable of sudden shifts from one zone of advance to another, when the enemy concentrates his strikes on a particular sector.[73] Botin's principal suggestion for achieving greater air defense mobility was the strengthening of the combined-arms commander's decision-making process, and heightened capacities for predicting hostile air activity.[74] It is interesting that at this point in the assessment continuum, the helicopter threat is still not considered significant enough that an extensive departure from standard methods is thought to be necessary. The call-to-action proposed here is one which augments existing procedures, revitalizing the process,

but not changing the basic structure. This early ambivalence which pervaded Soviet assessments of U.S. attack helicopters had dissipated completely by 1974. Starting in February of that year, a plethora of articles on combatting anti-tank helicopters appeared in the Ground Forces journals, detailing the various training and tactical changes that needed to be performed. The sudden, intense interest on the part of the Soviets can possibly be linked to two foreign and domestic technological breakthroughs. The foreign factor was the introduction of helicopter-launched TOW missiles to the conflict in Vietnam.[75] The domestic stimulus may have been the Soviet deployment of their first operational Mi-24D attack helicopters.[76] While a few of the early call-to-action proposals defy categorization, in general the near-term recommendations fell under the traditional rubrics of redeployment, expanded reconnaissance, improved training methods, and re-application of existing technologies. One of the suggestions made was to position observation units as close to the FEBA as possible in order to control firing operations. Colonel K. Adamov wrote in the March 1975 Military Herald that against helicopters without heavy armored protection, the tactic could prove to be quite effective.[77] An obvious drawback, however, is that this would put the fire command in the heart of the battle zone, and reduce considerably its probability of survival. Another re-deployment proposed were the alterations in ZSU and other antiaircraft units positioning. Colonel N. Molchanov in the June 1975 Military Herald stated that the suddenness of helicopter strikes required that during a high-speed march, antiaircraft systems should be positioned directly into the formations of the fighting units, and not 200-300 meters behind the

tank companies as had previously been the case.[78] This also necessitated a further modification: because the antiaircraft guns must not fall behind the regular fighting troops, stopping and properly setting up in order to beat a helicopter sortie could no longer be allowed.[79] They had to continue with the main force and fight while on the move. This development eventually resulted in the requirement that half of all antiaircraft batteries had to be "on station" at all times during a march.[80]

Changes in deployment formations were accompanied by revised training methods for the air defense troops in 1975. The primary change was in the speed at which training exercises were conducted. The Soviet press had reported in mid-1975 that helicopters using laser guidance systems had shortened the time for searching and detecting targets to under 10 seconds.[81] In response, complex tactical exercise conditions were created to develop not only the tracking and firing skills needed to combat such a high-speed threat, but the psychological stability as well.[82] A more fundamental change in training methods was the substantial increase in night exercises since 1975. If the number of articles in the Ground Forces press is an accurate indication, tactical exercises at night have become much more frequent in the last 10 years. Table 2 compares the number of articles in Military Herald and Znamenosets that include descriptions of night training exercises for the periods 1968-73, 1974-79, and 1980-84. The figures indicate a substantial rise in reported night exercises for the period 1974-79 compared with the five years previous, with the numbers for 1980-84 showing a slight drop from the 1974-79 figures. One likely factor behind this increase was the extra

difficulties for enemy aviation to acquire and destroy ground forces targets at night, a situation that continues to persist even with the improved IR systems of today. Major N. Kubrin in Znamenosets (April 1977) argued that exploiting the advantages of darkness was of a particular necessity at water crossings and when traversing open terrain.[83]

TABLE 2

Number of Articles Describing Night-Training Exercises:

	Military Herald	Znamenosets	Total
1970-74:	27	16	43
1975-79:	44	28	72
1980-84:	31	30	61

Concurrent with these training and re-deployment calls-to-action were proposals for the re-application of existing technologies. One of the earliest and most novel suggestions was submitted by Colonel A. Grabskiy in February 1975.[84] Grabskiy argued that fragmentation grenades would be particularly effective against helicopters. This proposal illustrated the severity of the threat that helicopters posed to Soviet ground forces. Helicopters had the capacity for firing down upon surface targets before the helicopters themselves could be visually detected. To counter this, Grabskiy asserted, fragmentation grenades -- when fired from medium-calibre batteries -- could travel beyond the range of visual reconnaissance and fragment in an area where helicopters had been

detected. The fragments and splinters could then serve as "shrapnel" against the relatively delicate body and mechanisms of the helicopter.[85]

Not all of the proposals for restructuring existing weaponry were as problematic as Grabskiy's. One that showed particular ingenuity was the Tolkachev and Vasin idea for establishing the range of anti-aircraft fire against low-flying helicopters.[86] The conventional method of aerial target detection was with the RPK (radio instrument complex). Unfortunately, in the case of low-flying targets such as helicopters, the accuracy of the range coordinates was often unsatisfactory, as radar emissions would often reflect off proximate objects instead of the attacking aircraft. The Tolkachev and Vasin alternative was to employ a "sight backup" (pritselom dublerom) as a substitute for the RPK system. This sight backup was basically a telescopic sight with an azimuth table. With the telescopic sight, the search operator would find terrain reference points and then consult the azimuth table in order to establish a sighting line on the search indicator.[87]

The Tolkachev and Vasin device is an example of what is considered an honored tradition in the Soviet military: the contributions of the "Innovators". In contrast to most western military systems, the Soviets give great weight to low-level weapon and equipment innovators, and even have organized innovator cadres in military training institutes.[88] Innovators can perhaps best be described as the Soviet application innovation response at its most basic level: the adroit soldier/technician in the field who responds to an enemy technological advancement with prosaic, but frequently effective, reconfigurations of existing equipment.

3.1.1 Design Innovation Response As was mentioned previously, "design innovation" entails the re-design of existing weaponry into a weapon system that provides a near-term response to enemy technological change. During the summer of 1974, the Soviet weapons development process came up with two design innovations, the SA-8 and SA-9, that turned out to be fairly effective defensive counterpoints to the capabilities of the U.S. helicopter gunship. The addition of the SA-9 was of particular significance, as it finally provided Soviet ground forces with an air defense system that could engage helicopters flying below 200m -- their preferred altitude. It seems unlikely, however, that Soviet tacticians at the time were completely confident about the impact that the deployments of the SA-9 and SA-8 would have on enemy helicopter kill ratios, given that the following year (1975) the Soviet military press churned out more low-level call-to-action suggestions against helicopters than any year before or since. It would not be until mid-1976 that calls-to-action against the rotorcrafts tapered off, implying that the initial deployments of the new antiaircraft systems did not leave Soviet analysts entirely convinced. In any case, there can be no doubt now that the 1974 deployments were of substantial importance, placing a much more comprehensive air defense network around the Soviet ground forces than had ever existed previously.

3.2 Soviet Responses to Stand-Off Technology: 1979-85

A new and more pernicious threat arose for the Soviet Ground Forces when western tactical air-to-surface missile (ASM) stand-off technology first appeared in early 1979. To designate these new technologies as

"stand-off" systems was actually somewhat erroneous, since stand-off ASMs had been in operation for some time. What set this new weaponry apart from its predecessors was that the distances from launch to target had been increased to as great as 6 km against armor, or about 3.7 miles. This meant that U.S. and other western aircraft could launch from inside friendly territory to attack enemy forces on the FEBA, and be beyond the effective range of even the best Soviet anti-aircraft systems.

Soviet reaction to stand-off systems followed a pattern of response similar to the earlier "pop-up" helicopter challenge with one significant difference: unlike the previous situation, there was no period of initial uncertainty and doubt as to the severity of the threat. The Soviet analysts who were the first to write about stand-off were unequivocating in their assessments of the dangers to armored units and air defense forces that stand-off technology imposed. Col. M. Chebataev noted in July of 1979 that "helicopters, with their ability for 'standing-off' from the scene of battle while maintaining a low altitude, makes them very hard to defeat."[89] Two months later, an article by Major-General Belov asserted that stand-off capabilities had made helicopters "next to invulnerable from ground weapons".[90] Several articles with similar sentiments appeared over the next six months, and by the spring of 1980, near-term responses to stand-off systems began emerging.

The first response to appear suggested a change in tactics. Since helicopters at stand-off positions would be very difficult to shoot down, Col. S. Gar'kavy proposed that helicopter support locations be targeted instead.[91] Of these, Gar'kavy designated enemy control posts as being of greatest importance, arguing that artillery barrages against the control

points could neutralize the flow of reconnaissance data that helicopters relied upon.[92] All of this, Gar'kavy acknowledged, would require a much greater commitment towards reconnaissance collection.[93] The Gar'kavy approach was buttressed by several follow-up articles that appeared in 1980 and 1981,[94] but it was by no means the only near-term reaction to stand-off helicopters that was proposed. Colonel P. Kanoplya asserted that the skillful use of smoke could be a very effective method in reducing the stand-off ATGM threat.[95] Several smoke-generating options were available, including the large smoke-producing vehicles used by the chemical troops.[96]

Despite the above mentioned proposals, however, there seemed to be a sense of desperation in many of the responses suggested for combatting stand-off systems. Two articles in Znamenosets discussed the rather dubious concept of "out-maneuvering anti-tank missiles in flight".[97] One tank commander claimed since there were approximately 15 seconds between an ATGM sighting and impact that "evasive driving can sometimes be effective".[98] For use against stand-off systems with IR guidance, it was suggested that a valve be attached to the gas tank so that gas and oil can be splattered over a wide area to confuse the IR sensors.[99] Suggestions of this type proliferated, but the proposals seemed to lack the credibility and official sanctioning that many calls-to-action in 1975-76 had received. One indication of this is that most suggestions for stand-off responses never appeared twice. Most official Soviet strategists apparently accepted early on that stand-off systems would have to be responded to technologically -- with helicopter-seeking helicopters.

3.2.1 Helicopter vs. Helicopter Combat A number of Soviet analysts seemed to have concluded that helicopter air combat will be decided by surprise and maneuverability. Colonel A. Doronin wrote that since "vigorous maneuver is the best means of setting up for weapons delivery, straight-line attack would be almost out of the question for helicopters of the same generation".[100] Perhaps even more important will be the element of surprise. The optimal attack, according to B. Gotin, is one in which the approach can be accomplished undetected, with maximum exploitation of all possible camouflage and concealment.[101] What will make this exceptionally difficult, as Gotin observes, is that "the final portion of the journey will have to be carried out over unfriendly territory."[102] There are compensating factors, however, as Major-General M. Fesenko writes in Aviation and Cosmonautics that the conditions of attacking stand-off helicopters are almost identical with the conditions of attacking a mobile ground target.[103] In addition, aiming requirements do not impose tough demands on pilots since the size of targets are fairly large, rate of movement is not too rapid, and determination of the lead distance is not difficult.[104]

It remains to be seen how successful the Soviet "killer helicopter" response will be in neutralizing the U.S. stand-off threat. What is clear is that the Soviets have again followed the pattern of employing low-level near-term tactics in an attempt to reduce the threat represented by stand-off technology. Looking in retrospect at the two series of responses discussed in this section, it is evident--whether or not the non-technological responses had substantive threat-mitigating effects (as

in the pop-up helicopter case) or whether the benefits have been primarily psychological (the stand-off case)--they are an integral part of the Soviet strategy and can be expected to play significant roles in future reactions to U.S. technological advances.

4. CONCLUDING OBSERVATIONS

It has been 15 years since the first articles on modern American CAS weaponry appeared in the Soviet press. Over that time, Soviet assessments have grown in sophistication as the threat posed by U.S. helicopters, ground-attack fighters, and stand-off missiles increased in severity. Part I of this report concentrated on the Soviet open press evaluations of U.S. CAS technology. Part II reviewed the Russian efforts at responding to the threats. This final segment will attempt to synthesize into a coherent continuum the progression of U.S. weapon innovations, Soviet assessments, and Soviet "calls-to-action" as they occurred during the past two decades. In doing so, a fairly consistent pattern should emerge--one which conforms rather closely to the model discussed in section II in which Soviet responses were shown to occur at various levels of innovation and technological sophistication. Hopefully, after this section merges the two lines of U.S. deployment and Soviet reaction, the implications of the Soviet assessment/weapons innovation process can be more clearly understood, and the task of predicting future Soviet responses to U.S. innovation will have been made somewhat simpler.

4.1 1968 - 1974

The time line for modern CAS operations begins in 1968, when the first U.S. discussions appeared on the feasibility of equipping helicopters with anti-tank guided missiles. At this point in time, Soviet interest in western CAS was still centered on fixed-wing aircraft; but by 1970 Soviet

ground force journals were mentioning in anti-aircraft articles, reports of U.S. interest in exploiting the anti-tank possibilities of helicopters; and in 1971 the first article specifically devoted to the helicopter as an attack vehicle appeared in Military Thought.[105] In all likelihood the stimulus for this article was the American development of the AH-56 Cheyenne, a project which the United States eventually cancelled but, by most accounts, was the prototype for the recently deployed Soviet Mi-28.[106]

In 1972, United States' research efforts came to fruition as the first UH-1Bs armed with anti-tank missiles flew into combat in Vietnam. Interestingly, the first Soviet calls-to-action against anti-tank helicopters had been published in the January 1972 issue of Military Thought, when Major-General M. Botin called for greater mobility in the tactical air defense forces in response to U.S. advances in helicopter technology.[107] Soviet assessments at this time still paralleled American skepticism about the usefulness of anti-tank helicopters on a European battlefield, but were nonetheless attentive to the developments taking place with helicopters and helicopter weapon systems. These countervailing currents were reflected in the laconic nature of Soviet assessments at this time, and in the ambivalent responses to helicopters proposed. This was also the year in which the A-9/A-10 fly-off competition began, with the United States finally prepared to produce a fighter aircraft for close air support missions.

While 1973 was a fairly uneventful year for both U.S. and Soviet CAS research developments, 1974 turned out to be a pivotal year for both CAS operations and efforts to defend against them. In January 1974 the United

States chose the A-10 over the A-9, thus opting for versatility and lower costs instead of superior survivability and lethality. Not to be outdone, the Soviets in 1974 test-flew their first attack helicopter, the Mi-24 Hind-D, which surprised western observers with its speed and sophisticated avionics.[108] This was also the year that the surface-to-air missiles SA-8 and SA-9 were first deployed, and when an upgraded ZSU-23-4 was introduced. But perhaps the most interesting emergence was the sudden upsurge in articles assessing U.S. anti-tank helicopters--a total of eight for the year compared to only two in 1973.

As was noted previously, most of the suggested responses discussed various tactical and training procedures in the general areas of redeployment and re-application of existing technologies. What was a bit surprising was that the bulk of the Soviet "near-term responses" came after the deployments of the intermediate-term design innovations -- the ZSU upgradings and the introduction of the SAMs 8 and 9. While at first inspection this response sequence appears rather incongruous, on closer scrutiny it can be surmised that a lengthy lag time often exists between Soviet design innovation deployments and acknowledgement (tacit or otherwise) of the effectiveness of the improvements. A. Lagovskiy noted in the November 1967 Military Herald that new weaponry is first used in special "chast" (units) until sufficient tactical-technical data is collected and the weapon is approved for distribution to regular units.[109] This would explain why calls-to-action against attack helicopters appeared long after the 1974 IOC (Initial Operating Capability) date, since there were still no assurances that the design innovations deployed would be adequate for the requirements of the mission. Secondly, production of ZSU

systems for example, occurred at a rate of only about 500 per year, so that even after general distribution was approved it must have taken quite a bit of time for all chasts to receive the new equipment, and thus the various application innovation suggestions would still prove useful for these units.

4.2 1975 - 1979

If 1974 was the year when Soviet assessments of U.S. close air support finally got off the ground, 1975 was the year that Soviet calls-to-action against CAS weaponry reached the jet stream, with articles in the ground force journals appearing at a rate of one a month over the course of the year. By 1975, little doubt remained as to the tank ambush capacities of U.S. helicopters, and Soviet analysts responded with a myriad of near-term suggestions for improving combat readiness and the creations of innovators. This was also the year in which Soviet articles on night training exercises increased substantially, and when U.S. research on night-guidance technology for NOE helicopter operations began in earnest. In looking at Soviet writings and tangible responses to the helicopter threat of this period, one point in particular seems especially relevant to attempts at trying to better understand why helicopters received such an enormous amount of attention: in Soviet eyes, attack helicopters had registered a capacity for slowing down and even smashing the momentum of a tank-led offensive. Ambush and pop-up helicopters were most effective when the opposing ground and air defense forces were on a march, i.e. when the anti-aircraft units did not have time to properly set up for combat, and ground forces could not make judicious use of terrain and other

protective measures. By being able to effectively slow up tanks and other armor during a march, helicopters presented an entirely different type of threat to the Soviet requirements for maintaining a constant forward thrust against enemy defenses. Lt. General Belov said as much in 1975 when he commented: "Helicopters have the ability of slowing advances, particularly at water obstacles, down to nothing. It has become the most dangerous anti-armor weapon of all."[110] In light of such strident, apocalyptic appraisals of the situation, it is rather surprising that by mid-1976 the amount of attention given to anti-tank helicopters in the Soviet press had slackened considerably. One possible explanation for the sudden declension in interest is that the overlapping networks created by the meshing of ZSUs, SA-8s, and SA-9s had genuinely ameliorated Russian concern over the attack helicopter threat. A contributing explanation could be that the stockpile of calls-to-action quick-response suggestions had been exhausted in 1974 and 1975, and there was little point in recapitulating proposals that had only recently been espoused. This possible explanation brings to mind an important question about Soviet calls-to-action in the open press: is it their principal purpose to simply acquaint the officer corps with the techniques and strategies for countering enemy threats, or is there also a more general objective of keeping the discussion of a serious threat alive in the public domain, even if the reservoir of application innovations has already been depleted and it becomes necessary to reiterate previously proposed response strategies? In the particular case of Soviet anti-CAS calls-to-action, it does seem as though some of the late-1975 articles varied only superficially from earlier approaches to the attack helicopter threat

(compare the March 1975 and November 1975 issues of Military Herald, for example), but the fact that interest in the topic seemed to suddenly disappear in 1976 implies that the new air defense deployments had reduced the gravity of the threat to a tolerable level, rather than the suggestion that the supply of short-term responses had been expended.

By 1977, U.S. CAS systems had virtually ceased to be an issue in the Soviet press with only two articles devoted specifically to U.S. attack helicopters, although the topic of helicopters did occasionally surface as important components to related discussions.[111] A particularly prominent 1977 debate, in which helicopters played an important, role was the exchange among Soviet tacticians as to the proper coordination between rates of advance and nuclear strikes for blowing open holes in enemy anti-tank defenses. After several months of discussion in the pages of Military Herald it was resolved that neutralizing helicopters and other anti-tank systems should be the top priority,[112] that attacking sub-units "podrazdeleniye" should rush through the breeches created by nuclear strikes to overrun helicopter bases and support sites,[113] and that once this is accomplished, combined maneuver and fire from tanks, armored personnel carriers, motorized rifle battalions, and artillery must prevent helicopter/anti-tank systems from occupying new positions.[114]

Soviet assessments of U.S. fixed-wing CAS returned to the open press in 1978 with an article in Zarubezhnoye voyennoye obozreniye that unfavorably compared the A-10 with attack helicopters, noting its difficulties at low altitudes and inability to operate in bad weather and at night.[115] This was also the first year in which references were made to fighting enemy helicopters with friendly helicopters that would cross

the FEBA on search and destroy, ferreting out the air-based anti-tank threats. Generally though, the lack of Soviet discussion on U.S. close air support systems that characterized 1976 and 1977 continued into 1978, even while the seeds were being sown for a second round of Soviet concerns about the air-based anti-armor threat. U.S. breakthroughs in stand-off technology (particularly target acquisitions systems associated with laser and IR guidance) soon became at least as menacing to the Soviets as were helicopter systems during the pop-up phase.

4.3 1979 - 1984

A year of unusual importance for developments in Soviet weapons research was 1979. The first Soviet tactical ASM for stationary targets -- the AS-7 -- was introduced, although why the Soviets took so long to produce one model of a class of weapons the U.S. had deployed almost 20 years before is a puzzle with no obvious solution. In addition, 1979 was quite probably the year in which the Soviet program for a long-term technological response to western stand-off helicopters -- the Mi-28 "killer helicopter" project -- was begun.[116] With regard to Soviet threat assessments and calls-to-action, 1979 was the year in which recommendations for near-term responses to stand-off systems (attack control posts, smoke generation) began to frequently appear in the Soviet press.

With the U.S. breakthroughs in long-range target acquisition, the second important period in Soviet writings and responses to CAS systems had begun. The era of stand-off technology has been of prime concern to Soviet tacticians for virtually the same reasons as during the pop-up

period, but with a few differences. The ambush helicopter's greatest assets were its maneuverability and low elevation. Anti-aircraft forces couldn't adequately track and target because of radar ground clutter and the mercurial flight paths of helicopters; but through intensified training, improved reconnaissance, and redeployments there were quick-fix counter-measures that could be initiated. As a consequence, numerous articles appeared in Soviet journals to advocate various responses in an attempt to neutralize helicopter attacks as much as possible. In the stand-off case, however, near-term application innovations were not nearly as effective, as stand-off technology essentially put the helicopter "out of range" of the air defenses and thus rendered most non-technological responses futile. As a result, stand-off systems -- even though a much greater threat to Soviet forces -- received less than half the attention garnered by U.S. attack helicopters of the mid-70s. One conclusion that can be drawn from this example is that the number of articles devoted to a particular subject is not necessarily the best measure for determining just how severe a threat the Soviets perceive a technology or weapon system to be. Ironically, in some cases a great amount of attention received is an indication that the threat is manageable enough so that Soviet analysts feel that something can be done about it.

A key component of stand-off technology is, of course, the missiles. As we have seen, there are by and large three generations of missiles around today; the first-generation wire- and radio-guided, and the second-generation laser-guided missiles -- both groups of which have already been deployed,

and the third-generation ASMs with self-homing devices that will be operational sometime in the late 1980s. The rather uneven path that Soviet assessments have taken in this area is interesting. About 10 years ago, Soviet analysts seemed to conclude that helicopter and ATGM technology was developing so rapidly that the tank was on the road to extinction. Then advanced armor and other innovations came along to reverse the trend, and the pendulum swung back in favor of the tank. Now it appears that Soviet strategists feel that western technology -- in this case microelectronics and data processing -- will once again place tanks and other armor in positions of extreme vulnerability.

This belies a more general problem that Soviet analysts appear troubled by: the specter of western technological synergy. The Soviets hold a true fear of the development of western "critical technology mass", the snowballing of western technological output that can produce military by-products or "artifacts of innovation" simply from its great size and internal dynamism. A prime example of this type of artifact are the small digital computers that are now being placed aboard helicopters[117] and navigation originally developed for satellites that automate "capitalist" helicopters, takeoff, hover, and landing efforts.[118] In addition, Soviet tacticians have noted that systems developed in complete independence-- such as, laser target-acquisition and infra-red guidance systems -- can eventually be merged into a hybrid technology such as imaging infra-red (IIR), where the two systems combined eliminate the deficiencies that each was afflicted with on its own.[119]

A bit more prosaic but still useful example, was a Soviet article on the U.S. light alloy industry -- how (in finding a way to make cheaper

aluminum cans) their research was eventually used by U.S. defense contractors for building bigger, faster, and more economical helicopter engines.[120] It is clear that technological synergism is not a topic which receives a great deal of specific attention in the Soviet press, but is nonetheless an issue whose essence pervades throughout much of modern Soviet writings on U.S. military technology.

In contrast to the rapid CAS developments of the 1970s, the 1980s has been a less frenetic, more stable period characterized mainly by the extensive research and testing of third generation CAS systems. The years 1980 and 1981 were dominated by the continuation of past trends and efforts, with U.S. research progressing in the refinement of various stand-off missiles and guidance technologies--in particular, the WAAM program (Wide-Area Attack Munitions) and the Soviets pursuing the development of the Mi-28 helicopter. It would be 1982 before a new CAS delivery system for either side was introduced, when the Soviets deployed the SU-25 Frogfoot in Afghanistan. The Frogfoot was the first post-war Soviet fixed-wing aircraft specially designed for CAS missions, and as mentioned before, appeared to share more of the attributes of the rejected U.S. plane -- the A-9 -- instead of the A-10.[121] It was also in late 1982 that production of the U.S. Hellfire missile was launched, a project that began five years before and had been the missile most discussed in Soviet examinations of U.S. stand-off technology. Expectations are that over 35,000 Hellfires will be produced by 1990.[122]

In 1983, Soviet articles on combat between helicopters broadened into discussions of tactics and air-to-air missiles systems as the expected day when helicopters would be fighting it out above ground forces engagements

drew closer. The bevy of Soviet assessments appeared earlier than the growing western interest in helicopter "dogfight" scenarios, most of which came out in 1983 and 1984. A possible stimulus for the U.S. articles was the 1984 confirmation of the existence of the Mi-28 Havoc, the Soviet "anti-helicopter helicopter."[123] There has been some speculation that the Havoc most clearly resembles the design of the Ah-56 Cheyenne, the first U.S. attack helicopter program that ended in failure and cancellation. It would be quite ironic if both Soviet CAS aircraft innovations of the 1980s -- the Su-25 and Mi-28 -- were in large part copies of designs the U.S. had long ago rejected.

4.4 Final Thoughts

A legitimate question that should be asked at this point is: "What can be learned from all this?" In answering that question, it is useful to reiterate that the driving force behind these series of reports is the issue of U.S. interpretation and response, i.e. does the United States effectively interpret (and hence respond) to the Soviet weapons innovation process? While arriving at a satisfactory resolution to this question is obviously beyond the scope of this report, the efficacy of the debate is furthered by a detailed analysis of Soviet assessments of U.S. weapon technologies in a particular family of missions (in this case close air support) in cooperation with Soviet weapons innovation efforts, be they application, design, or technological.

One clear (and admittedly unsurprising) connection between Soviet assessments and weapons innovations has been the frequency of Soviet assessments/discussions of U.S. weaponry and the relative vigorousness of

Soviet innovation responses. The plethora of Soviet articles on U.S. attack helicopters in the early 1970s was later consolidated with new deployment and training procedures, changes in tactics, and the reconfiguration of off-the-shelf technologies that resulted in a highly efficient overlapping defense network. A similar pattern emerged in response to the many Soviet articles detailing U.S. stand-off capabilities. Various short-term innovations were quickly released, and research was soon begun on a long-range technological response -- the Mi-28 Havoc.

The Mi-28 is an important example of how Soviet weapons innovations are greatly influenced by U.S. weapons developments. The new rotorcraft is not simply an augmentation of the capabilities of its predecessor, the Mi-24, but is a weapons innovation that should significantly improve on the military-mission performance of the Mi-24, by virtue of it having had the lessons of U.S. weapons advances incorporated into the overall design. This should result in the Mi-28 not simply doing what the Mi-24 already does -- only better -- but should instead result in the new craft being able to respond more effectively to the present need of Soviet ground forces: a weapon that can neutralize the debilitating effects of the stand-off helicopter.

The SA-9 is another Soviet response to U.S. technology that reflects the inculcation of lessons learned about U.S. ambush helicopters and configurations designed to mitigate their success. While both the SA-9 and its predecessor the SA-7 were assigned the mission of shooting down low-flying aircraft (principally helicopters), the SA-7 did a poor job of this because its small size made it portable, but not terribly lethal, and

only when fired in salvos could there be worthwhile results. As a consequence of this deficiency, the Soviets developed the SA-9 system, which consisted of a scout car with quad-mounted missiles emplaced upon it, providing the Soviet antiaircraft gunners with four times as many missiles per launch.[124] While the SA-9 missiles were larger and more maneuverable than those of the SA-7 systems, they were not a dramatic leap forward in technological performance; the alterations were mainly in the method of deployment. But in terms of mission performance there did result a substantial improvement in capability. What is important about both cases -- the technological innovations of the Mi-28, and the off-the-shelf design innovations of the SA-9 -- is that the key criterion is mission effectiveness, and the various innovation levels and stages are resolutely directed towards the enhancement of that objective.

In comparing Soviet and U.S. assessments of U.S. close air support, the most significant finding is that for any given weapon system, Soviet assessments are at least partially independent of what's being written about that weapon in the West. While one could find many examples of situations where the Soviets published a book or article on a particular system primarily because it had been receiving a great deal of attention in the West, some of the cases mentioned in this report indicate that much of what the Soviets write about U.S. technology is not dependent upon what's being written in the West at all. Early Soviet expectations of the ultimate role of helicopters, even going so far as to predict a nuclear warhead delivery role for the rotorcraft, and the Soviet (unexpected) preference for the A-9, are examples of Soviet assessments that are largely predicated on the determination of the potential capability or

threat of a weapon technology, and not on the published Western assessments.

A question that still remains: What fundamental purposes do Soviet assessments of U.S. ASM technology appear to serve? Certainly, one genuine purpose conforms with Soviet stated intentions: They provide the Soviet military community current information on the threat from enemy technology. The myriad of articles that appeared on the capabilities of attack helicopters were intended to develop cognizance of the severity of the threat, and to supply methods for countering it. The data that was released on the AH-64s night-time capabilities for example, was not only meant to make military personnel aware of the particular characteristics of the technology, but to also reinforce the significance of activities such as night maneuvers. Examples such as this reflect the strong inter-relationship in Soviet assessments between describing the nature of a threat, and conveying to those who must respond to the threat the proper counter-measures.

It should not be construed however, that providing the troops with information on the enemy is the only purpose behind the Soviet assessment process. In the CAS area, assessments seem to have been frequently used as justification for existing (and sometimes proposed) Soviet military programs. The threat from U.S. anti-tank helicopters was certainly a legitimate threat that merited extensive Soviet attention, but the enormous disparity between the number of reports on helicopters and that of fixed-wing aircraft is an imbalance that suggests that other considerations may also have been involved. It is hard not to notice, for example, that just as attention paid to U.S. helicopter gunships was

reaching its zenith (1975), the Soviets were deploying their own attack helicopter, the Mi-24D. In similar fashion, little was heard from the Soviet press about fixed-target CAS missiles until a number of articles appeared in the late 1970s. Coincidentally (or perhaps not so coincidentally), the late 1970s just happened to be the period when Soviet fixed-target ASMs (the AS-7 in particular) made their debut. Examples such as these give credence to the assertion that the Soviet military, like their American counterparts, will often use their discussions of the opponents weapon systems as ammunition and justification in the bureaucratic fight for domestic military programs. In "evaluating the evaluators" then, it should be remembered that unseen internal forces are an important part of the Soviet assessment process as well.

With this compilation of data as a cornerstone, can future Soviet assessment and response patterns be predicted? While an assertion of absolute prophetic accuracy would be absurd, there does exist enough evidence to facilitate a better understanding of Soviet response operations. Within the parameters of this study, Soviet assessments of and responses to close air support systems has been a process only partially in rhythm with the ebb and flow of U.S. commitments to military research and development. It is a process that while definitely reflecting advances in U.S. technology, is nonetheless a component of an internal agenda as well. The military press assessments, for example, often appear to be tools used by competing bureaucracies for directing attention towards a particular weapon system, and in some instances to act as catalysts for series' of articles in which the proper responses are debated and calls-to-action proposed. By the same token, in publishing

"calls-to-action" Soviet military journals are simultaneously concerned with sustaining public scrutiny and the discussion of a threat while providing a forum for low-level response ideas that would not otherwise be heard. As time passes, the near-term reactions diminish and are replaced by more technological responses; responses, however, that are intended to counter the threatening U.S. system, not duplicate it. The Soviet response to stand-off technology, for example, was not stand-off systems of their own but helicopters that could seek out and destroy the U.S. systems. Moreover, Soviet responses and calls-to-action reflect not only existing or stated U.S. weapon capabilities, but unstated potential threats that a particular technology may pose. American helicopters in the early 1970s were primarily used for transport, reconnaissance, and search and rescue operations. Yet Soviet analysts at the time recognized their potential for anti-tank operations, a capacity (as late as 1974) many U.S. experts considered the helicopter incapable of performing effectively.[125]

Taken together, an understanding of these considerations forms a clearer picture of the internal-external dynamics of Soviet assessments/responses. In a nutshell, the guiding tenets of the process appear to be:

1) Western stated intentions or current deployment policies are not relied upon, as assessments include potential as well as existing threats of a weapon system;

2) Neutralization, not duplication, is the proper response to new enemy technology;

3) Responses will occur at different levels of time, magnitude, and

technological complexity, and will be oriented towards mission effectiveness, not simply technology advancement.

Our ability to predict future Soviet reactions to U.S. weapons developments is still rather limited. But if Soviet reactions to U.S. weapons developments in the past are any indication, the response strategies outlined above will almost assuredly be important components in the overall Soviet assessment/response structure.

NOTES

1. Everett-Heath (1983; 321).
2. Everett-Heath (1983; 322).
3. Everett-Heath (1983; 322).
4. Merritt (1971; 1).
5. Everett-Heath (1983; 323).
6. Stepans (1974; 3).
7. Everett-Heath (1983; 323).
8. See Georgiyev (1965; 120).
9. Weinhold (1971;58).
10. Weinhold (1971; 58).
11. Weinhold (1971; 59).
12. Weinhold (1971; 59).
13. Weinhold (1971; 60).
14. Andrukhov (1971; 58).
15. Laing (1973; 1).
16. Momyer (1974; 75).
17. Momyer (1974; 75).
18. Botin (1972; 86).
19. Semenov (1973; 47).
20. Gatsolayev (1973; 117).
21. Gatsolayev (1973; 118).
22. Stepans (1974; 7).
23. Stepans (1974; 7).

24. Momyer (1974; 76).

25. Stepans (1974; 2).

26. Stepans (1974; 3).

27. Belov (1974; 218).

28. Belov (1974; 220).

29. Arduini (1975; 4).

30. Alekseyenko (1978; 51).

31. Alekseyenko (1978; 51).

32. Alekseyenko (1978; 52).

33. Jane's Aircraft (1980-81; 275).

34. Jane's Aircraft (1980-81; 279).

35. Shishov (1979; 69).

36. Shishov (1979; 71).

37. Shishov (1979; 71).

38. Kibardin (1980; 57).

39. Kluyev (1980; 83).

40. Kluyev (1980; 84).

41. Aviatsiya i kosmonavtika (1980; 82).

42. Jane's Aircraft (1984-85; 238).

43. Jane's Aircraft (1984-85; 274).

44. Reznichenko (1976; 3).

45. Belov (1979; 10).

46. Belov (1979; 12).

47. Worden (1984; 7).

48. Worden (1984; 7).

49. Chernukhin (1980; 41).

50. Nelin (1980; 43).

51. Anthis (1967; 36).

52. Drendel (1966; 113).

53. Momyer (1974; 70).

54. Momyer (1974; 74).

55. Gorton (1970; 101).

56. Grobev (1972; 48).

57. Deryabin (1973; 102).

58. Momyer; (1974; 71).

59. Jane's Aircraft (1984-85; 262).

60. Antonov (1978; 35).

61. Antonov (1978; 37).

62. Skinner (1983; 77).

63. Osipov (1982; 30).

64. Osipov (1982; 32)

65. Osipov (1982; 32).

66. Tsoubanos (1978; 1).

67. Kartenichev (1982; 58).

68. Kartenichev (1982; 58).

69. Gatsolayev (1973; 188).

70. Gatsolayev (1973; 192).

71. Botin (1972; 86).

72. Botin (1972; 86).

73. Botin (1972; 89).

74. Botin (1972; 90).

75. Stepans (1974; 4).

76. Jane's Aircraft (1974-75; 286).

77. Adamov (1975; 170).

78. Molchanov (1975; 146).

79. Molchanov (1975; 147).

80. Samoylenko (1976; 171).

81. Molchanov (1975; 147).

82. Afanesenko (1975; 153).

83. Kubrin (1977; 42).

84. Grabskiy (1975; 46).

85. Grabskiy (1975; 46).

86. Tolkachev (1975; 77).

87. Tolkachev (1975; 78).

88. Radziyevskiy (1978; 56-57).

89. Chebatayev (1979; 130).

90. Belov (1979; 10).

91. Gar'kavy (1979; 76).

92. Gar'kavy (1979; 76).

93. Gar'kavy (1979; 77).

94. See for example, Ivanov (1981; 106).

95. Kanoplya (1979; 31).

96. Kanoplya (1979; 31).

97. Grabin (1980; 45).

98. Grabin (1980; 45).

99. Grabin (1980; 46).

100. Doronin (1984; 72).

101. Gotin (1984; 31).

102. Gotin (1984; 32).

103. Fesenko (1984; 72).

104. Fesenko (1984; 73).

105. Weinhold (1971; 58).

106. Jane's Aircraft (1984-85; 286).

107. Botin (1972; 86).

108. Jane's Aircraft (1975-76; 421).

109. Lagovskiy (1967; 33).

110. Belov (1975; 3).

111. Slyusarenko (1977; 96).

112. Lobachev (1977; 73).

113. Lobachev (1977; 73).

114. Lobachev (1977; 74).

115. Antonov (1978; 37).

116. Jane's Aircraft (1984-85;583).

117. Biryulin (1980; 28).

118. Biryulin (1980; 29).

119. Rykunov (1983; 29).

120. Tamanskiy (1982; 25).

121. Jane's Aircraft (1984-85; 239).

122. Dmitriyev (1981; 57).

123. Soviet Military Power (1984; 60).

124. Isby (1981; 265).

125. Momyer (1974; 75-76).

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