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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

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6 July 1973

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Transport Aircraft Losses During Airborne Operations

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought." This article refers to the heavy losses incurred by transport aircraft delivering and dropping airborne troops and suggests ways to reduce these losses. The author's major argument is to provide the transports with terrain avoidance radar so that they can overfly enemy territory and drop troops at an altitude of 300 meters. Formulas for predicting losses are provided in a table. This article appeared in Issue No. 1 (89) for 1970.

2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies.

[redacted]

W. E. Colby
Deputy Director for Operations

[redacted]

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SUBJECT

MILITARY THOUGHT (USSR): Overcoming Enemy Air Defense Countermeasures by Military-Transport Aviation

SOURCE Documentary

Summary

The following report is a translation from Russian of an article which appeared in Issue No. 1 (89) for 1970 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought." The author of this article is Colonel N. Reshetnikov. He recommends specific measures for reducing losses of transport aircraft in airborne operations, such as reducing the drop altitude from 800 to 300 meters. He points out that the aircraft cannot fly at this altitude under combat conditions because they lack terrain avoidance radar. They are therefore quite vulnerable to enemy air defenses and require long-range fighter support to the drop zones. Since the air army of a *front* does not have sufficient aircraft to provide this cover, aircraft will have to be provided by adjacent *fronts* or the Supreme High Command. Formulas for calculating transport losses under various drop conditions are provided.

End of Summary

[redacted] Comment:

Lieutenant Colonel N. Reshetnikov was the author of an article appearing in the SECRET version of the Collection of Articles of the Journal "Military Thought," Issue No. 5 for 1961 titled "On the Development of the Theory of the Combat Employment of Front Aviation in the Postwar Period" [redacted]. Military Thought has been published by the USSR Ministry of Defense in three versions in the past--TOP SECRET, SECRET, and RESTRICTED. There is no information as to whether or not the TOP SECRET version continues to be published. The SECRET version is published three times annually and is distributed down to the level of division commander.

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Overcoming Enemy Air Defense Countermeasures by Military-Transport Aviation

by Colonel N. Reshetnikov

The experience of World War II, of command-staff war games, of troop exercises in the postwar period, and the analysis of many research projects, show that the main determining factor in the successful conduct of airborne operations must be considered to be the assurance that units and large units of military-transport aviation can overcome strong and deeply echeloned enemy air defense with minimal losses.

During the Second World War, airborne drops and landings took place only when there was supremacy (superiority) in the air, when powerful air preparation of enemy targets could be conducted in the drop areas, and when the actions of transport aviation could be supported directly by other arms of aviation during the drop period. Thus, for example, 1600 transport aircraft and 1400 gliders participated in the Rhine airborne operation conducted by British and American forces in March 1945. To achieve success, 55,000 sorties were made by combat aircraft in the five days preceding the start of the landings in order to destroy German defensive installations. In the culminating stage of the operation, more than 5000 fighters and 3000 bombers provided support and cover for transport aviation in the air.

Despite the complete air superiority of Anglo-American aviation, the powerful preliminary preparation of the landing areas, and the direct support of transport aviation actions by bombers and fighters, 440 aircraft were heavily damaged and 53 shot down by enemy fighters and antiaircraft artillery fire; this comprises over thirty-one percent of the total number of aircraft participating in the landings. The Anglo-American command considers such losses quite significant.

In a number of research works it was shown that, under modern conditions, permissible losses of up to fifteen percent of all the military-transport aircraft used in a large-scale airborne landing can constitute a significant absolute number. For example, in landing one airborne division, the losses will be set at 60 aircraft (not counting those which are damaged). In the two-sided combined-arms training exercise "Dnepr," conducted in September 1967, in order to preserve the combat effectiveness of large units (units) of military-transport aviation and of troops landed, it became evident that losses from enemy air defense weapons should not exceed three to four percent (which, in the landing of one airborne division, comprises up to 20 aircraft).

Therefore, in planning the actions of military-transport aviation in airborne operations, there must be provisions for a number of measures by military-transport aviation itself and by large units of other branches of forces and arms of troops to destroy enemy air defense weapons and to ensure the most effective tactical movements by units and large units of military-transport aviation. In estimating possible military-transport aviation losses here, we must proceed from the requirement to avoid exposing any planned airborne operation to the threat of disruption and to preserve military-transport aviation as long as possible, since in time of war its recuperability will be low, while demands on it for fulfilling other, no less vital, missions will be very great.

Through research into the measures taken by military-transport aviation for overcoming enemy air defenses, it has been established that losses of military-transport aircraft can be appreciably lowered by more rational choice of flight routes and optimal combat formations for units and large units; by the overall operational structure of military-transport aviation; by narrowing the permissible flight zones; and by exploitation of low and very low flying altitudes, complex weather conditions, night flying, jamming equipment aboard military-transport aircraft, and possibilities for maneuvering in flight over enemy territory. All of this must be assimilated as much as possible into units and large units of military-transport aviation. A review of the problems of exploiting low and very low flying altitudes deserves special attention, as does the structure of combat formations of large units and units of military-transport aviation.

During combat training and exercises in the recent past, parachute troops and combat equipment have been dropped from altitudes of 800 to 1100 meters, which were also the flight altitudes over enemy territory. In the "Dnepr" exercise, flight routes above enemy territory were at altitudes of 100 to 150 meters. The experience of this exercise showed that climbing up to 800 to 1100 meters when approaching the drop zone is unfavorable from the viewpoint of overcoming enemy air defenses. Therefore, at the end of 1967 experimental drops of personnel, combat equipment, and cargo were made from low altitudes. These drops indicated that with minor changes in existing parachute equipment, it will be possible to lower the drop altitude by a factor of two, with the safe drop altitude diminishing to 300 meters for personnel, because of the reduced parachute stabilization time (three seconds instead of the established five); to between 150 and 200 meters for cargo no heavier than 500 kilograms in weight when cargo parachute systems are replaced with unstabilized personnel parachutes; and to between 300 and 400 meters for platforms for all systems with equipment and cargo, made possible by the immediate activation of the main canopies (at the moment the platforms emerge from the bay of the aircraft).

At the "Spring Thunder" (Vesenniy Grom) exercise in 1968, two parachute regiments were dropped from 400 meters for the first time. This was the beginning of practical implementation of drops from low altitudes, which will significantly reduce not only losses of military-transport aircraft to enemy air defense weapons but also losses of airborne landing personnel during the drop. There will also be a decrease in the time needed to bring these troops to a state of readiness for aggressive combat actions.

In deciding how to structure the combat formations of units and large units in order to have the lowest possible losses from enemy air defense weapons, we must take into account the kill zone of the conventional and nuclear missiles of fighter aircraft and SAM batteries, as well as the kill zone of conventional enemy antiaircraft artillery.

Calculations show that if military-transport aircraft are flying at a speed of 550 miles per hour, there must be a minimum time distance of two to fifty seconds between them to assure the least probability of their being hit by conventional and nuclear missiles from enemy air defenses.* The densest possible combat formations of military-transport aviation are advantageous for overcoming air defense countermeasures when conventional charges are used but disadvantageous if nuclear weapons are used.

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*The interaircraft navigation equipment available in military-transport aviation units permits combat formations with time distances of up to thirty seconds between planes.

The extent to which combat formations should be compressed must be determined in each individual instance, depending on exactly how the situation develops. In order to overcome the countermeasures of enemy air defense forces and weapons with minimum losses, the combat makeup of units and large units, as well as the operational structures of military-transport aviation as a whole, must in principle be so organized that the time distances between small groups or individual aircraft make it possible to cause the SAM batteries to switch their fire successively from one target to another, thus ruling out a simultaneous strike by one missile of the "air-to-air" or "surface-to-air" class, with conventional or nuclear charge, against several detachments flying in "wedge" combat formation or against several aircraft in "single file" combat formation.

The overall capabilities of military-transport aviation for overcoming countermeasures by enemy air defenses are limited at the present time, and the successful resolution of this vital problem is being hampered by several factors. First, AN-12 aircraft do not have a terrain relief monitoring system allowing them to fly at low and very low altitudes (existing equipment aboard these aircraft allows them to make drop flights at night and under complex daytime weather conditions at altitudes of 300 to 400 meters above the highest point of terrain relief along the flight route, while under simple daytime weather conditions they can fly missions visually at altitudes of 100 to 150 meters). Second, military-transport aviation has a very imperfect system of interaircraft navigation (this "gap" can be filled to some extent by the combined use of existing radioelectronic devices and the instrumentation on the AN-12 aircraft).* Third, the

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*An improvised system of interaircraft navigation was created by efficiency experts of military-transport aviation through the combined use of onboard equipment: the PDSP-2 sight system, the SPO-3 radiation warning station, the SOD-37 aircraft transponder, and the RBP-3 radar sight with RPM-S attachment. Combined use has made it possible to observe visually, on the RBP-3 screen, the return impulses from aircraft flying ahead and on parallel routes, and to maintain the necessary distances between aircraft flying single file or between columns of aircraft flying on parallel routes. However, such a system does not permit interaircraft control between two files at different altitudes on the same route, it has poor resistance to jamming, and it is inapplicable in a combat situation since each of its components has its own proper function.

defensive armament of military-transport aircraft does not satisfy many of the demands made upon it, and it does not include jamming equipment and "air-to-surface" missiles for aggressive combat with radioelectronic means of enemy air defense. And, finally, units and large units of military-transport aviation have very limited maneuverability when flying in dense combat formation and also because of their general operational structure (dense formations of several hundred aircraft can maneuver only to bypass individual SAM batteries which were detected but not destroyed or which were not detected beforehand).

The foregoing shows that in order for large units of military-transport aviation to succeed in overcoming enemy air defenses, we must accelerate the equipping of their aircraft with active and passive jamming devices, "air-to-surface" missiles (on the principle of homing in on sources of radiation), a system for continuous monitoring of ground relief, and a more advanced system of inter-aircraft navigation.

Among the measures to be taken in support of military-transport aviation by formations (large units) of other branches of forces and arms of troops in order to assure the overcoming of enemy air defense countermeasures, the most important are the destruction of the active means of enemy air defense in the flight zone, the organization of radioelectronic countermeasures, and the provision of fighter cover for large units and units of military-transport aviation.

It has been established through calculations that in combat actions using nuclear-missile weapons, the enemy air defense system can be fifty to sixty percent neutralized by pre-drop missile and air strikes by the end of D2; but not more than forty percent neutralized only by the end of D3 when there is a non-nuclear period in an air operation to rout an enemy air grouping. If the enemy air defense system is even fifty to sixty percent neutralized, the probability of its being overcome by military-transport aviation making drops of one airborne division to a depth of up to 800 kilometers will not exceed 0.5. To assure a probability of 0.8 to 0.9, enemy air defense forces and weapons must be eighty-five to ninety-five percent neutralized. In this case, losses of military-transport aircraft may be up to ten percent while flying in for the drop and up to five percent on the return flight. In order to achieve such a position, particularly when combat actions are conducted with conventional strike weapons,* a considerable force of front and long-range aviation must be detailed directly for support of units and large units of military-transport aviation. This force may comprise up to 330 to 350 sorties by fighter-bombers and bombers of front aviation and up to 100 sorties by long-range aviation for the destruction of enemy air defense targets during the drop of one airborne division to a depth of 200 to 250 kilometers in a non-nuclear period of operations. In addition, more than 250 to 300 fighter sorties must be allotted to provide cover for large units and units of military-transport aviation.

An air army composed of one bomber, two fighter-bomber, and two fighter air divisions must expend an average of thirty-five to forty percent of its daily sorties in order to protect military-transport aviation during the drop of one airborne division. In actuality, however, it may allot up to fifteen to twenty percent, (depending on whether there is a nuclear reserve and if other missions must be fulfilled in support of troops of the front). Consequently, requirements for drawing on forces from other arms of front aviation in order to support military-transport aviation exceed the capabilities of one air army of a front. This makes it necessary to reinforce the air army by using long-range aviation and units from the forces of the air armies of neighboring fronts. It must be kept in mind here that the capabilities of front aviation to mount strikes will be limited if the drop takes place during daytime hours under complex weather conditions or at night.

Thus, requirements for supporting large units and units of military-transport aviation will increase especially when combat actions are conducted with conventional means of destruction, despite a decrease in the depth to which the airborne landing force is dropped. Therefore, in a non-nuclear period it is recognized as advisable to have up to two or three divisions of fighter-bombers and up to two divisions of bombers in the composition of a front in whose zone of responsibility the drop flight is taking place. In conducting an airborne landing operation in this period it is necessary to strive for maximum destruction of enemy air defense installations on the flanks and in the flight zone of large units and units of military-transport aircraft. As shown by calculations and by the experience of World War II, we must

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*Taking into account the conduct of an air operation for routing an enemy air grouping.

not spare forces or means in providing for the successful overcoming of enemy air defenses by military-transport aviation, since the successful landing of a large airborne landing force may also produce an important operational or operational-strategic result.

The capabilities of military-transport aircraft for overcoming enemy air defense countermeasures increase considerably when the aircraft are equipped for active and passive jamming. Under appropriate conditions, the taking of radioelectronic countermeasures with equipment aboard military-transport aircraft makes it possible, as calculations show, to decrease by a factor of about 1.2 to 1.8 the quantity of forces which must be detailed from front and long-range aviation for the destruction of enemy air defense weapons. By using combined and individual jamming means and "air-to-surface radar" missiles, units and large units of military-transport aviation not only lower their losses from enemy air defense weapons but also decrease the dependence of these losses on flight altitude. Therefore, if for any reason it is impossible to fly at low and very low altitudes over enemy territory,* wider use must be made of the defense means indicated above when flying at medium altitudes in order to reduce losses from enemy SAM, fighter aircraft, and antiaircraft artillery.

The tasks of covering units and large units of military-transport aviation on flight routes and in drop areas during a non-nuclear period of operations can actually be carried out by forces of front fighter aviation, since the drop depth (200 to 250 kilometers) will be within the radius of operations of the fighters and of the control means located on the ground or on radar patrol aircraft. But under these conditions, considering the limited forces of fighter aircraft included in air armies, more attention must be given to protecting large units of military-transport aviation in the air, since our probable enemy anticipates using more than half of his air defense fighter aircraft in front of the SAM strike zone, i.e., beyond the front line. It is considered advisable to include no fewer than two or three divisions of fighters in air armies of fronts within whose areas of responsibility the landing flights are taking place.

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*Especially for adjusting the depth of a landing of parachute and landed echelons of an airborne force.

The most complicated aspects of cover operations are the organization and implementation of cover for large units of military-transport aircraft (mainly because of the limited radius of operations of front fighters) on flights over enemy territory particularly in a nuclear period of operations and in the areas where the flights terminate and the drops are made. In this connection, the need becomes obvious to have long-range escort fighters included in the Air Forces.

In landing large airborne forces for operational-strategic purposes, it is not ruled out that, after the drop of even one airborne division, fighters of the air army of the front, in whose area of responsibility the landing is taking place, may organize maneuvers at airfields in the drop area in order to cover military-transport aviation in the sectors in which flights terminate, and in the drop (landing) areas of airborne and light motorized infantry divisions dropped subsequently in order to back up the efforts of the landing force. An equally important way of solving the question of support for military-transport aviation actions is to assure the destruction of enemy fighters on the flanks and in the flight zone of large units of military-transport aircraft, when they are outside the range of front fighters, by forces and weapons of the Strategic Rocket Troops (of fronts) and of long-range aviation.

These, in our opinion, are the most important concepts concerning questions of assuring that large units of military-transport aviation can overcome enemy air defense countermeasures; there is no doubt that they must be studied most carefully in planning for the use of military-transport aviation in any airborne landing operation.

Along with this we must point out the full complexity of determining the effect of the whole complex of measures, as well as the special importance of individual measures; this determination furthers the most effective overcoming of enemy air defenses in a specially developed situation. However, it is only with difficulty that several existing recommendations regarding these questions are put into practice in the work of staffs. Thus, for example, the use of combined and individual jamming means allows losses of military-transport aircraft to be reduced by a factor of two to three; reduction of the distances between flight routes from thirty down to ten kilometers increases the probability of penetrating into the drop area by a factor of 1.5 to 2; the probability of overcoming air defenses at night or under complex daytime weather conditions is greater by a factor of 1.5 to 2 up to 2 to 2.5 than under normal daytime weather conditions; reduction of the flight altitude from 3000 down to 300 meters increases the probability of overcoming air defenses by a factor of 1.5 to 2; etc. In order to take stock of the totality of all of these factors and conditions of operations, it is obviously necessary to work out a unified methodology and a single criterion for evaluating the effectiveness with which enemy air defenses are overcome. As such a criterion we may use the extent of possible military-transport aircraft losses from enemy air defense weapons. The level of development of mathematical research methods and computer technology at the present time ensures the solution of this problem. In an operational-tactical plan, these losses (in the final result) must obviously be determined by the parameters shown in the attached table.

Having different variants with quantitative data on possible military-transport aircraft losses from enemy air defense weapons, it would be possible to apply with greater objectivity the index of forces and weapons which must be detailed from other types and arms of aviation (in direct support of military-transport aviation), to evaluate the advantages and shortcomings of other factors (especially the use of radioelectronic countermeasures), and to make an overall determination that combination of measures which will further the overcoming of enemy air defenses in a specifically developed situation with minimal losses.

Thus, assuring that large units and units of military-transport aircraft can overcome the countermeasures of a strong and deeply echeloned enemy air defense must be considered as the most important condition for the successful conduct of any airborne landing operation, particularly in actions using conventional means of destruction. Overcoming air defenses with minimal losses is a very complex problem demanding a practical as well as a theoretical solution.

Standard Method of Determining Losses of Military-Transport Aircraft from Enemy Air Defense Means

Basic input parameters	Possible losses	
	With separate calculation of input parameters	With combined calculation of input parameters, cumulatively
Enemy air defenses 50 to 60% neutralized in first strikes with use of nuclear weapons (or 35 to 40% in an air operation to rout an air grouping with use of conventional means of destruction)	x	x
With allotment of forces and weapons for neutralization of enemy air defenses by other branches of armed forces and arms of service in direct support of military-transport aviation:		
For aggressive destruction of enemy air defense installations	$x - a_1$	$x - a_1$
For covering large units and units of military-transport aviation in the air	$x - a_2$	$x - \sum_{i=1}^{2} a_i$
For radioelectronic countermeasures against enemy air defense forces and means	$x - a_3$	$x - \sum_{i=1}^{3} a_i$
Organization of radioelectronic countermeasures by resources of military-transport aviation only	$x - a_4$	$x - \sum_{i=1}^{4} a_i$
Organization of radioelectronic countermeasures by forces and means of long-range aviation, <u>front</u> aviation, the <u>front</u>, and military-transport aviation	$x - a_5$	$x - \sum_{i=1}^{5} a_i$
Shortening of distances between flight routes of large units of military-transport aircraft	$x - a_6$	$x - \sum_{i=1}^{6} a_i$
Different variants of combat formations of units and large units in the overall operational structure of military-transport aviation	$x - a_7$	$x - \sum_{i=1}^{7} a_i$
Actions of large units and units of military-transport aviation at night	$x - a_8$	$x - \sum_{i=1}^{8} a_i$
Actions of large units and units of military-transport aviation during daytime under complex weather conditions	$x - a_9$	$x - \sum_{i=1}^{9} a_i$
Actions of large units and units of military-transport aviation during daytime under normal weather conditions	$x - a_{10}$	$x - \sum_{i=1}^{10} a_i$
Actions of large units and units of military-transport aviation at various altitudes	$x - a_{11}$	$x - \sum_{i=1}^{11} a_i$
	$x - a_k$	$x - \sum_{i=1}^{k} a_i$ *

[*Translator's Note: Subscripts are unclear.]