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CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

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MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (TOP SECRET): "Several Questions on Evaluating the Effectiveness of the Basic Means of Antiair Defense of a Front, and Its Organizational Structure", by Colonel-General of Aviation S. Mironov

1. Enclosed is a verbatim translation of an article which appeared in the TOP SECRET Special Collection of Articles of the Journal "Military Thought" ("Voyennaya Mysl") published by the Ministry of Defense, USSR, and distributed down to the level of Army Commander.

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Richard Helms
Deputy Director (Plans)

Enclosure

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COUNTRY : USSR

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Several Questions on Evaluating the Effectiveness of the Basic Means of Antiair Defense of a Front, and Its Organizational Structure

by

Colonel-General of Aviation S. Mironov

The thinking abroad is that aviation will continue to be the basic means of delivering nuclear warheads for a long time to come, since the overwhelming majority of targets in the theaters of military operations are small in size and highly mobile, and the combat operations of both sides extremely mobile. The enemy's arsenal of means of attack includes flying apparatuses which represent air attack weapons with high combat capabilities. And, in our view, these characteristics should determine the nature of the requirements on the system of weapons of the PVO troops of ground troops.

As is known, among the basic tasks carried out by front PVO troops are: reconnaissance and destruction in the air of enemy means of air attack; neutralization of his ground and aerial radiotechnical means of control and guidance; destruction of airborne troops while in flight to the landing area, and at the landing area; and warning the front troops and the PVO of the Country about an enemy air raid.

To carry out these tasks, the front PVO has at its disposal radiotechnical troops, antiaircraft artillery, antiaircraft missiles, and fighter aviation.

It is completely obvious that any system of troop formation, including that of the front PVO troops, will attain the highest combat and operational effectiveness if the role and place of all basic combat means in the system are correctly defined.

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Therefore, it would be advisable to examine in detail the role and place of the basic combat means within the PVO system of a front, especially since the press has carried articles in which authors have presented contradictory views, sometimes highly praising one type of weapon while undeservedly depreciating the value of another. For example, in a number of published articles, authors proclaim the decisive role of antiaircraft guided missiles in destroying an air enemy, while clearly underestimating fighter aviation, which, even at the present time, in our opinion, represents one of the primary means of PVO, especially the antiair defense of troops.

It must be noted that in most cases such statements are made by authors without adequate grounds or concrete analysis of the combat capabilities of all PVO means.

It seems to us that it is fundamentally wrong to single out only one of the combat means in deciding on a system of weapons for the antiair defense of troops. Because any weapon, even the most sophisticated one, always has its weak points which the enemy can exploit to facilitate his own task of overcoming PVO.

Experience of armed combat very strikingly demonstrates the necessity of a harmonious combination of all means of combat, since in this way the most effective use is made of the strong points, and the weak points are compensated for, in each of these means, thus causing them to complement each other.

In this connection, we shall examine the basic tactical-technical characteristics and the combat and operational capabilities of the principal PVO means of a front and try to establish their true significance on the basis of specific calculations and on the experience gained from exercises.

In view of the fact that antiaircraft tube artillery now carries out only a limited number of tasks, namely, directly covering objectives from strikes by low-flying, low-speed

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aircraft and helicopters and also combating airborne landings, we shall dwell on the analysis of combat capabilities of antiaircraft guided missiles and fighter aviation.

Antiaircraft guided missiles (ZUR) are a very effective means of antiair defense. Their probability of destruction of single targets represents an average of 0.80 to 0.85. They are less affected by meteorological conditions than other types of weapons of the PVO troops.

At the same time however, antiaircraft missile complexes possess a number of negative characteristics which reduce their combat and operational capabilities. The first of these is the low maneuverability of antiaircraft guided missile units. Thus, in a situation in which the ground troops are advancing at a rate of 80 to 100 km per 24-hour day, the full complement of guided missile units can participate in covering the troops only when the latter are in the initial position or when they are delayed by the enemy at some intermediate line; and only an insignificant part of the guided missile forces can provide cover in the course of a swift maneuver of troops.

Also contributing to the above situation is the great amount of time required to bring the antiaircraft guided missile complexes into combat and march readiness. For example, it requires 3 to 5 hours to bring a missile complex to combat readiness and 3 hours to dismantle it. Because of the great weight of missile equipment (up to 11 to 14 tons), its extreme sensitivity to road-surface irregularities, its limited capabilities of climbing and descending steep grades and managing sharp curves (the turning radius of a prime mover with a launching mount is not less than 10 meters), the speed at which a mount can be moved at night is only 10 km per hour.

Thus, in view of the high rate of advance of ground troops and the missile complex's limited effective casualty radius (35 to 50 km), the forward elements of troops will advance beyond the ZUR zone of cover every 5 to 6 hours unless the latter can effect a timely advance to new positions. In view

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of the above-mentioned shortcomings, it is inadvisable to make frequent shifts in the disposition of antiaircraft missile complexes over short distances. While they are deploying to a new position, the ground troops will have advanced an average of 15 to 20 km, i.e., they again will have moved beyond the protective zone of a given missile complex.

Even under the most favorable of circumstances, in which the missile complex is relocated only once every twenty-four hours, up to 19 hours will be required to dismantle, move and set it up. Thus, even under the most favorable conditions the maximum amount of time left for the combat employment of the complex in a 24 hour period is 5 hours. Even with a slower rate of advance by the ground troops, there will be virtually no increase in the time available for the combat employment of missile complexes because of the aforementioned reasons. Consequently, the existing antiaircraft missile complexes essentially are means of protection of stationary objectives; while in operations of fronts they apparently will be used only for the protection of troops in important operational positions, and, most effectively, during lulls in operations.

Antiaircraft missile complexes installed on chassis of assault guns will possess higher maneuver capabilities. However, even this will not ensure a rapid concentration of missile troops in a required area during the course of an operation.

The second important shortcoming of missile complexes which sharply reduces the combat and operational capabilities of antiaircraft missile regiments is the exceedingly great amount of effort spent in the preliminary preparation and checkout of missiles. The productivity of a technical battalion under field conditions is extremely low. Even with well-trained personnel working under favorable conditions, a technical battalion can prepare, with only a checkout of

the complex, a maximum of 20 to 22 missiles in a 24-hour period; while a checkout of missile-borne instruments in their complete program (using two lines) can be done on 10 missiles in a 24-hour period. In view of the fact that a technical battalion is not provided with a reserve supply of missiles, it will be compelled to carry out a full program checkout of missiles received from front and army bases. Thus, an antiaircraft missile regiment will be able to destroy only 5 targets from among the enemy means of air attack in a 24-hour period (on the basis of two missiles for one target), and this under the most favorable conditions and without taking enemy opposition into account.

Another shortcoming of antiaircraft missile complexes that should be mentioned is the fact that they can destroy only those targets flying above 3000 meters. Thus, a situation may develop in which antiaircraft missile complexes will be unable to destroy a large part of the air targets flying at low altitudes. It should also be borne in mind that, because of the characteristics of the methods of detecting low-flying targets, the complexes designated for destroying them have an extremely limited range of fire, and a large number of complexes will be needed to provide adequate protection for front troops.

The combat capabilities of antiaircraft missiles are also reduced because of the lengthy preparation for launching from readiness No. 2. Experience proves that to bring a complex from this condition of readiness to readiness for fire takes 8 minutes if the diesel generators are running or if some other power supply is being used and up to 13 minutes if the diesel generators are turned on when the command is given to prepare the complex for firing. It is evident that the amount of warmup time (passivnoye vremya) is quite great, and in order to have the time to launch a missile at a target flying at a speed of 420 m. per second, it has to be detected at the distance of 245 and 370 km respectively. For example, to destroy a B-47, which has the lowest speed of this class of aircraft, it is necessary to detect it at a distance of 130 and 200 km

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respectively. But since the search and target acquisition radar set, P-12M, detects a medium bomber flying at 20,000 m only at a distance of 240 km and a fighter at 180 km, there is not enough time, as a rule, to prepare the missile complex for firing from the moment the target is detected. Thus, the present antiaircraft missile complex, when in readiness No. 2, does not ensure the destruction of the most probable indicated targets; and when in readiness No. 1, it ensures the destruction of targets flying at speeds up to 1500 km per hour, and has a limited capability against those flying at speeds up to 2000 km per hour. Furthermore, a complex can remain in a condition of readiness for launching only 25 minutes, and at least 20 minutes are required to get the complex ready for another launching.

The short range of fire of antiaircraft missile complexes and the exceptionally high speeds of modern aircraft sharply limit the possibility of timely missile launchings. Thus, a target flying at the speed of 420 meters per second (1500 km per hour) is in the zone of destruction of an antiaircraft missile complex for 67 seconds, and a target flying at the speed of 560 meters per second (2000 km per hour) for only 50 seconds.

A number of the design characteristics of an antiaircraft missile complex limit its capabilities of reliably destroying any type of target. In particular, the destruction of a maneuvering target is possible when its angle of approach up to the moment of impact with the missile does not exceed 55 degrees. For the same reasons there are also prohibited areas at an azimuth of 40 degrees and an elevation of 45 degrees. The presence of a single guidance channel (tselevoy kanal) in an antiaircraft missile battalion ensures simultaneous fire against only one target.

Unquestionably, antiaircraft guided missiles represent a new, effective, and very promising type of weapon. There is no doubt that the continuous process of development and perfection will see an improvement in their tactical and technical characteristics and an increase in their combat capabilities. The antiaircraft guided missiles and controlling radar stations mounted on assault gun chassis, which are now being issued,

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have better maneuverability characteristics than the previous ones, while the creation of missiles with engines that operate on solid fuel will sharply increase their combat readiness. However, because of a whole series of specific characteristics of antiaircraft missiles, which exist in future systems as well, it is our view that we should not expect in the future to be able to concentrate, within short periods of time, their main effort in a required area in the course of an offensive operation and, especially, while an air raid by enemy aircraft and cruise missiles is under way. This is also determined by the short range of fire of missiles, by the comparatively weak protection against jamming, and by large limitations of a design nature in launching the missiles.

In view of all the abovementioned, we are not inclined toward considering antiaircraft guided missile complexes as the principal and decisive force in a system of antiair defense of troops of a front.

We shall examine the tactical-technical characteristics and the tactical and operational capabilities of fighter aviation.

Modern fighter aircraft armed with missiles of the "air-to-air" type also possess a high probability of target destruction (0.8 to 0.9) and can destroy one aircraft or one cruise missile of any type in one attack. Thus, the modern fighter in essence has become a highly maneuverable, flying ZUR launching mount, while retaining its most valuable and most important quality - the high probability of target destruction.

High maneuverability of fighter aviation constitutes its most important quality, which is needed especially in antiair defense, when the initiative in regard to the type of action and time and direction of the strike always belong to the attacker. It is perfectly obvious that only fighter aviation can be concentrated and employed in mass in the course of an air enemy attack that has already begun and at the exact place and time of the greatest danger and threat to the troops

and to the most important objectives of the front. With its long range of fire and by using a wide maneuver, fighter aviation is capable of providing the necessary correlation of forces in a required area to repulse successfully an enemy attack in any sector of a front and on the flanks of cooperating fronts. Ensurance of moving from one airfield to another (aerodromnyy manevr) by aviation along the line of the front does not present any particular difficulties. On the other hand, ensurance of such moves by aviation while following advancing troops at the present high rates of advance presents, just as in moves of antiaircraft missile troops, definite complexities and difficulties. For example, the volume of excavation necessary in the construction of a field fighter base on terrain of average ruggedness is up to 10,000 m^3. One engineer-airfield battalion can prepare such a field in 24 to 48 hours. As is known, the volume of excavation work necessary in the first stage of preparing an antiaircraft missile regiment's siting area is 8230 m^3 and can be carried out in 24 to 48 hours by the forces and means assigned for the work. Thus, the time necessary to prepare field fighter bases and ZUR siting areas is about the same. However, the time necessary to move them to new positions is different, just as the respective ranges of these PVO means differ. Moreover, the solution of the problem of vertical takeoff and landing will give fighter aviation a new quality - operating without airfields, which will immeasurably increase their combat and operational capabilities.

Fighter aircraft is the only means of antiair defense combining within itself the qualities of defense and attack. They can not only repel raids already under way, but can also disrupt them by combined bombing-strafing attacks against airfields and against launch sites for missiles and cruise missiles and by the destruction of enemy aircraft during takeoff and while assuming flight formation.

Fighter aviation is capable of destroying the enemy's radiotechnical means. Two fighters can completely put out of action a guidance radar station of any class or designation. Because of their great range of fire, fighters can destroy

"air-to-surface" missile-carrying aircraft which launch their rockets beyond the effective range of the front's ZUR, as well as, nuclear-weapon-carrying aircraft at distant approaches. Modern methods of aerial, radiotechnical and other types of reconnaissance permit the timely disclosure of the enemy's preparations for take-off or of aircraft already underway and the immediate dispatch of fighters to destroy them.

Until recently, the accuracy in directing fighters and intercepting air targets was not high enough, mainly because of the known physical limitations of combat crew personnel at command posts. With the issue of mobile, automated systems of control, which are now being mastered successfully in units and large units of fighter aviation of air armies, the accuracy of guiding and intercepting air targets is rising sharply, and the combat and operational capabilities of fighter aircraft as a whole are increasing.

Because of automation in the processes of collection, processing and transmittal of data, the warmup time is being sharply curtailed, the lines of interception are being moved toward the enemy, the capabilities for intercepting low-flying targets are increasing, the time necessary for the guidance process is being cut, and the capabilities of simultaneous guidance are being enlarged, as a result of which a fighter division consisting of three regiments with four command posts, using the communication channel for guidance, can simultaneously direct 21 to 25 fighters (groups) against 21 to 25 targets (groups of targets). The arming of fighters with "air-to-air" missiles which permits an air target to be attacked from any direction will greatly increase the capabilities of aviation to destroy the enemy at great distances from the front line. This is particularly important for carrying out intercepts at low altitudes, which at the present time are accomplished behind the front line over one's own territory, because of the limited range at which radar can detect low-flying aircraft and the necessity to direct the fighter against the target aircraft's rear (rear hemisphere-zadnyaya polysfera).

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It should be noted that fighter aircraft operations are dependent upon meteorological conditions to a greater extent than are antiaircraft missile troops. Under normal meteorological conditions, as well as below or behind clouds, and depending on the level of training, the full complement of fighters can participate in repelling enemy aircraft and cruise missiles; while in the clouds at night, only a part of the forces, in planes with radar and infra-red instruments, can participate. Thus, the combat capabilities of fighters to intercept enemy aircraft in the clouds are significantly lessened. In this connection, a continuous process is taking place in the armed forces of equipping air armies with all-weather fighters. In addition, it is necessary to bear in mind the limited capabilities of a probable enemy to deliver strikes from the clouds and at night, since his basic delivery vehicle of nuclear weapons, as has been previously noted, is piloted aircraft.

From the point of view of economics it would be interesting to compare the cost characteristics in the construction of each type of weapon in use.

It is known that the overall material expenditures in creating a combat-ready fighter regiment are significantly higher than for an antiaircraft missile regiment. However, after aviation and antiaircraft missiles have been used three times in combat to achieve a similar combat effect, the economic indices are in favor of aviation equipment. With further frequency of use, this difference becomes even more perceptible.

The experience from World War II, calculations of combat effectiveness and losses of aviation equipment, and taking into account the modern means of counteracting aircraft, show that the average number of missions per plane is between 30 and 50. These data permit aircraft combat means to be classified among the most advantageous from the economic standpoint.

A brief analysis of the tactical-technical characteristics and the combat and operational capabilities of antiaircraft

guided missiles and fighter aviation indicates that both these means have a number of positive and negative sides. Neither antiaircraft guided missiles nor fighter aviation is a universal weapon, guaranteeing the independent achievement of all goals and the solution to all problems of antiair defense of a front. In our view, both of these means should be combined in the front PVO system, complementing each other and reciprocally compensating each other's negative qualities and raising the effectiveness of each. However, the principal role should belong to fighters.

Let us briefly examine several questions relating to the organizational structure of a front's antiair defense.

As is known, control of the antiair defense of a front is the responsibility of the PVO chief of the front ground troops. At the same time, radiotechnical troops and the basic PVO means (that is, antiaircraft guided missiles and fighter aviation) are in the T/O & E of the combined-arms armies, air armies and the front itself. Such a distribution of PVO forces and means between the types of armed forces and arms of troops significantly reduces the effectiveness of their utilization as a whole, since the organization of coordination is encumbered, the necessary efficiency of control is not assured, and serious obstacles are placed in the way of concentrating forces and means and utilizing them expediently. Moreover, the front PVO chief does not have the necessary forces and means to organize and carry out the control of antiair defense.

Control over the basic PVO means is organized in a rudimentary manner and carried out from various command posts: fighter aviation is controlled from the command post of the air army; antiaircraft missile troops are nominally controlled from the command post of the front PVO chief, but actually are controlled from the command posts of the combined-arms armies.

Experience from exercises in groups of forces and in military districts during 1960-1961 completely confirms the

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indicated shortcomings in the organizational structure of front PVO troops.

It is perfectly apparent that such organizational dispersion and lack of a clear system of centralized control contradict the basic principle of the necessity for mass utilization of PVO forces and means, hinders the development of a clear organizational structure of PVO troops in peacetime, and can lead to grave consequences in time of war.

In our opinion, it is advisable to centralize control over radiotechnical troops, ZUR units, and fighter aviation at the front level. This proposition is in keeping with the general principles for the utilization of combat means and will scarcely cause any doubt.

Naturally, the question arises as to how to organize most advantageously the direction and control over the PVO forces and means of a front. It seems to us that direction and the entire weight of responsibility for antiair defense of a front should be placed on the commander of the air army, according him the appropriate rights (without changing in this connection the direction of PVO in armies and large units). Such a proposal is based on the following reasons.

In the first place, one of the basic PVO means, fighter aviation, is under the direct subordination of the air army commander and, being a versatile weapon, it can be used for a large number of other tasks along with PVO tasks. At the same time, fighter aircraft can most effectively carry out their assigned tasks only when under centralized control and in mass utilization. Therefore, the solution, in which direction of the front antiair defense is carried out by someone else, for example, the front PVO chief, will naturally lead to the splitting up of fighter aviation forces, to decentralization of its control, and, consequently, to a sharp decrease in its combat and operational capabilities. Besides this, the means available in the air army for aerial and long-range radiotechnical reconnaissance can assure a high degree of efficiency in the control over all PVO means and completely satisfy the needs of antiaircraft missile troops (ZRV) for long-range radiotechnical reconnaissance data.

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In the second place, a modern air army is mainly composed of fighters and fighter-bombers, which combine the qualities of the means for defense and attack and can, in the course of an operation, and depending on the ground and air situation, switch a significant part of its forces or its entire complement over to carrying out the task of antiair defense of a front or to the support of combat operations of ground troops, or, what will most frequently be encountered in practice, to carrying out both tasks simultaneously.

Along with this, as a result of the dynamism of a sharply and quickly changing ground and air situation in modern operations, it frequently becomes necessary to switch considerable air army forces which are already carrying out PVO tasks over to the support of combat operations of ground troops in exceedingly brief periods of time, even to the point of redirecting aircraft already aloft. Such a situation requires exceptionally efficient control, organization, and maintenance of coordination, which is possible only under strict centralization of control in the hands of the aviation chief alone, who is carrying out tasks of antiair defense of troops and support of combat operations of the front in an operation of all the forces of the air army.

In the third place, the commander of an air army has available to him a control apparatus in the form of a staff which has highly qualified specialists with considerable experience in directing aircraft in carrying out their diversified tasks, including PVO tasks. An air army staff and its command post are equipped with the necessary technical means and have specialized combat teams. Moreover, from the time they were created in the armed forces (1942), air army staffs have been carrying out PVO tasks at the front level, as a consequence of which the transfer of the direction over all PVO of front ground troops to the commander of an air army and his staff would be the logical continuation of a further improvement in the PVO system of a front, assuring the continuity of combat experience and tradition on a modern basis. Thus, the already available control apparatus in an air army, with the necessary T/O & E (command posts) and trained personnel, could

direct the entire antiair defense of a front with insignificant reinforcements of appropriate specialists. There is no similarly prepared apparatus in a front at the present time. Therefore, if it is decided to be done differently, it will be necessary to create a new, special control organ, which will entail the expenditure of large means and will significantly increase the T/O & E. And, what is most important, such a control organ will not be able to direct effectively the use of one of the basic PVO means -- aviation.

In the fourth place, as air armies are equipped with automated systems of control of fighter planes, the capability of intercepting the air enemy will be significantly increased, the time required for the collection and processing of intelligence information on air targets will be sharply reduced, and, with the further improvement of these systems, the automated control of the basic PVO means from command posts of the air army commander will become possible. Naturally, the utilization of an automated system of control also presupposes the unification of all front radiotechnical troops for centralized resolution of the tasks of detecting the air enemy and a sharp reduction in the time necessary for the processing and transmittal of the necessary information to command posts of PVO means, as well as the time required to alert the troops.

In the fifth place, great flexibility and uninterrupted control, with an extensive use of diversified and complex technical means, and the availability of a highly qualified control apparatus familiar with the specific characteristics and features of aviation, are necessary for more complete realization of high maneuverability of front aviation under a sharply and rapidly changing situation.

Thus, the problems of direction and organization of antiair defense of a front can, in our opinion, be successfully solved only if the front has, under the jurisdiction of, for example, the deputy front commander for aviation and PVO, a responsible person who has fighter aviation and radiotechnical means subordinate to him and antiaircraft missile units under his operational subordination. In this case, the most effective and

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mass use of each of the combat means, the efficient and precise control over them, and the uninterrupted coordination of all forces in a sharply and quickly changing operational situation will be assured, in accordance with the front troop commander's concept of the operation and his official decisions.

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