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4 June 1973

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): Combat Employment of Orbital Aircraft

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 discusses the principles of employment of strategic aerospace weapons systems. Operational concepts are described both for orbital systems and those operating in low and near space zones. Missions for such systems are identified as weapon delivery, reconnaissance, and destroy or capture action against hostile spacecraft. This article appeared in Issue No. 2 (75) for 1965.

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.

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Deputy Director for Operations

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MILITARY THOUGHT (USSR): Problems of the Combat Use of Orbital Aircraft

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SUMMARY

The following report is a translation from Russian of an article which appeared in Issue No. 2 (75) for 1965 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought." The author of this article is Colonel V. Odintsov. He asserts that aerospace combat vehicles represent a new phase in the development of strategic weapons and reconnaissance systems. He defines these as manned and unmanned earth satellites and aerospace aircraft capable of operating both within the upper limits of the atmosphere and across into low space areas. Advantages over existing strategic attack systems, as well as limiting factors on aerospace systems such as maneuverability, are described in principle in the article. Destruction or capture of hostile space vehicles are identified as primary missions for aerospace weapons systems.

END OF SUMMARY

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[redacted] COMMENT:

Colonel V. A. Odintsov coauthored a reference book on cosmonautics with General-Mayor N. Ya. Kondratyev which was reviewed in the Air Defense Herald, Issue No. 11 for 1966. 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 comm 50X1-HUM

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Problems of the Combat Use of Orbital Aircraft

by Colonel V. Odintsov

The effectiveness of the employment of nuclear armament, and therefore the course of armed combat, depends in a decisive way on the availability of delivery vehicles capable of delivering nuclear weapons to their targets. As is known, such strategic delivery vehicles presently include intercontinental and intermediate-range missiles, missile submarines, and missile-carrying aircraft with a wide radius of operation.

Each type of delivery vehicle has its own inherent combat characteristics. Thus, with strategic long-range missiles it is possible to strike targets at great distances in a short time. Aircraft have the advantages of practically unlimited maneuverability in the air and the capability of independently finding and destroying various land and sea targets (including moving targets). Missile submarines can remain for extended periods on lines of communication in the most remote areas of ocean theaters of military operations.

However, there is no one perfect delivery vehicle at the present time, and the capabilities of all existing delivery vehicles are contained within well-defined and often very rigid limits. For example, regardless of whether they are launched from stationary installations or from submarines, missiles can be used only against targets whose coordinates are determined in advance; after the missiles are launched, it is difficult or impossible to retarget them. Aircraft are not always able to assure the necessary operational range and swiftness of strike and also overcome strong air defenses.

Therefore, the perfection of existing strategic delivery vehicles and the development of the most effective and economical new delivery vehicles represent the most vital problems in the development of our Armed Forces.

At the present time a new direction has been defined in the development of delivery vehicles for nuclear weapons and reconnaissance systems--the development of aerospace combat vehicles capable of striking various targets and of conducting strategic and operational reconnaissance. Depending on the region of space in which these vehicles are to be used, they can be conditionally divided into two groups. The first consists of earth satellites and spaceship-satellites for extended flight at relatively high altitudes, from 200 to 250 kilometers and higher. The two types of satellites are distinguished from each other principally by whether they are or are not manned; earth satellites are unmanned space vehicles, while spaceship-satellites may carry a crew. The maneuverability of this type of space vehicle is very limited, while the majority of earth satellites cannot maneuver at all.

The second group consists of space aircraft--orbital and aerospace--capable of flying at low space altitudes (60 to 150 kilometers) where the density of the atmosphere is fairly high in comparison with other parts of space.

Orbital and aerospace aircraft presuppose the presence of a crew, are launched from delivery aircraft, and land like ordinary aircraft. Orbital aircraft can complete only two to five orbits at low altitudes, while aerospace aircraft can maintain flight for many days.

From the viewpoint of technical realization, orbital aircraft may be regarded as an immediate prospect in the development of space aircraft. As regards aerospace aircraft, their development requires the solution of numerous technical problems, and this type of flying vehicle will therefore be the next stage in the development of space weapons systems. However, the general principles governing the combat application of aerospace aircraft will in many respects be analogous to those of orbital aircraft.

On the whole the problem of the development and use of space aircraft is already expanding beyond the limits of purely theoretical research and is assuming features of reality. However, it is a very broad and complex problem. For this reason, the present article will review some of the positions on the role of orbital aircraft in armed combat and the principles governing the combat use of these aircraft.

Let us dwell, first of all, on those circumstances which have made it expedient to develop and produce orbital aircraft.

The development of space weapons systems is subject to the same rules as the development of other types of armament. Means of attack and defense are being created simultaneously for combat in space. Therefore, one of the indispensable requirements of space weapons systems is to be able to fulfil their objectives successfully even if the enemy has antispace defenses. An analysis of the capabilities of space vehicles to overcome antispace defenses shows that their capabilities will be greatest at a flight altitude of 60 to 120 kilometers. This is explained by the fact that the distance at which space targets can be detected at these altitudes by radar and optical equipment on the ground is not great enough to enable antispace defense measures to be taken in time to intercept and destroy the space targets. It is in this range that orbital aircraft are to operate, which gives them substantial advantages over vehicles flying at higher altitudes. We may draw an analogy here with aerodynamic means whose capabilities for overcoming antiaircraft defenses reach their maximum at the low altitudes of 50 to 300 meters.

Another important feature of orbital aircraft is that they are more capable of maneuvering in flight than are other types of space vehicles.

It is known that at an altitude of 150 kilometers the density of the atmosphere is so low (tens of thousands of times less than on the ground) that it is practically impossible to use aerodynamic lift for maneuvering to gain altitude or change direction. Therefore the maneuvering of space vehicles at these and higher altitudes can only be accomplished with the help of special rocket engines. This is called rocket maneuvering, as distinct from aerodynamic maneuvering in which aerodynamic forces are exploited. If rocket and aerodynamic forces are used together, the term combined maneuvering is applied.

With the present nature of fuel used in the maneuvering engines of space vehicles, capabilities for changing direction by rocket maneuvering are estimated at only four to six degrees. To change the orbital plane by 15 to 20 degrees, however, requires almost as much fuel as to launch a space vehicle. As a result, rocket maneuvering, the only possible type for earth satellites and spaceship-satellites, can be used only for small deviations from the original orbit (for correctional, defensive, and landing maneuvers).

One of the ways to increase the maneuver capability of spaceship-satellites is to use composite space systems, in which a fuel compartment is launched separately into space and is joined to the basic ship. Under combat conditions, however, the problem of mating will be a complex and vulnerable part of the system.

Maneuver capabilities increase significantly with the combined use of rocket and aerodynamic forces, but this is possible only for space aircraft capable of flying at near space altitudes. Combined maneuvering at altitudes on the order of 100 kilometers makes it possible to double the maneuver capabilities of a space vehicle. Descent into the denser atmospheric layers from 80 to 60 kilometers above the surface creates even more favorable conditions for maneuvering, to a maximum of several tens of degrees. A vehicle in flight may maneuver in order to increase the probability of avoiding antispace defenses, to widen the choice of targets and the axes of approach to them, and to make another approach to a particular target from a second orbit.

The positive qualities of orbital aircraft also include relatively great economy of operation. It must be taken into account that in order to fulfil combat tasks successfully with a minimum expenditure of forces and means, it is necessary not only to detect the target and determine its coordinates but also to acquire a target image of sufficiently large size. In particular, this will make it possible in actions against large target areas to destroy individual critical elements of the target without destroying the entire target area. The demands on strike means in such actions may be appreciably reduced, depending on the nature of the target and the location of its critical elements. Detailed reconnaissance becomes extremely important here.

Thus, in actions against carrier strike large units, for example, it is necessary to know the combat formation of the ships and to determine the location of the strike carriers and ships acting as false targets. At the same time, in order to be able to fulfil tasks for destroying individual pinpoint targets and critical small elements of area targets, we must increase the strike accuracy of our attack means. Unguided weapons of destruction dropped from space vehicles have a probable deviation of several kilometers. Such a low level of accuracy will require strike weapons of unjustifiably great power in order to destroy the most critical strategic targets.

The use of orbital aircraft with sufficiently reliable navigation and guidance systems makes it possible to acquire

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large-scale target images while carrying out reconnaissance missions and to significantly increase the accuracy of strike weapons; this will create conditions for more economical and effective use of nuclear strike weapons. At the same time, the guidance system, which assures radar contact with the target, makes it possible to pick out errors in our determination of target coordinates and in the delivery vehicle's course toward the launch point of its weapons.

Finally, and also of great importance, orbital aircraft serving as delivery vehicles are capable of autonomous action. This quality, a characteristic of aircraft, enables the crews of space aircraft to carry out independent search and destruction actions against critical enemy targets in a given area and also to perform retargeting over a fairly broad zone.

The crew of a reconnaissance orbital aircraft, for example, will be able to evaluate the situation, complete an initial review of reconnaissance data, transmit the most urgent and vital information to their command point or to other orbital aircraft, make expedient decisions on the basis of available information, systematically exploit their reconnaissance resources, provide target designation for strategic missiles and nuclear submarines, and carry out other missions not achievable with unmanned flying vehicles.

In carrying out tasks for the destruction of targets, a crew may conduct active target search, perform the guidance of strike weapons of the "space-to-earth" type, monitor the results of a strike by orbital aircraft and other strategic weapons, carry out retargeting tasks, and take measures to inhibit the effectiveness of enemy countermeasures.

Let us look briefly at the main combat characteristics determining the capabilities of orbital aircraft for use in combat. In principle, orbital aircraft launched from a cosmodrome in the Soviet Union can proceed to any point above the earth after completing one orbit. Starting from a given launch point, a space aircraft may approach its target from two axes, one of which, the main (shortest) one, assures reaching the target in the minimum time, while the other approach, the auxiliary one, requires more flight time. 50X1-HUM

The choice of the approach axis to a given target depends above all on exactly how the situation develops, on the organization of enemy antispace defenses, and on the general plan of use of strategic forces in mounting nuclear strikes. Thus, if orbital aircraft are obliged to proceed against assigned targets before our ballistic missiles have crossed the detection line, then, regardless of the type and disposition of antispace defense weapons, the main approach axes will be used in most instances in order to shorten the total strike time. On the other hand, if circumstances are such that space aircraft can take off appreciably before the ballistic missiles are launched, and if this does not reveal the overall plan of a massive strike, then the approach may be along the auxiliary axes, especially if this facilitates overcoming enemy antispace defense systems.

In choosing the approach of a space aircraft to its target, consideration must be given to such factors as the axis on which the space aircraft is launched, natural light conditions, assurance of communications with command points, coordination of actions with those of other types of strategic delivery vehicles and with reconnaissance, time available for reaching assigned targets, etc.

Launch axes of space aircraft can be divided into eastern, western, and polar. Launch toward the east is most economical from the viewpoint of energy expenditure, since the space vehicle acquires initial velocity based on the rotation of the earth. However, in a combat situation, the decisive factor in choosing the launch axis may not be the energy expenditure factor but other factors, such as the general plan for the use of delivery vehicles, the time available, or other factors assuring high effectiveness in the fulfilment of the combat mission.

It must be noted that the establishment of an approach on two fixed axes to a given target prevents maximum exploitation of the element of surprise and facilitates enemy organization of antispace defenses.

What are the possibilities for widening the sector of approach of orbital aircraft to assigned targets? First of all, considering the geographical position of our territory, we can move the surface launch points. Thus, with launch points located in the area between 50 and 60 degrees latitude, a ten-degree change in the

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longitude of the launch point will make possible a change of five to six degrees in the axis of approach to a target in the United States. However, if we take the whole band of indicated latitudes in our country, the approach sector for the main and auxiliary axes will be 70 to 80 degrees.

The possibilities for changing the axes for approach to strike targets may be significantly increased by launching orbital aircraft from the air. In this case, the dispersal of launch points within a radius of 700 to 1000 kilometers will provide for an average of eight to twelve degrees in the axis of approach to targets at distances of 10,000 to 15,000 kilometers. If we assume that an air launch makes it possible to increase combat readiness, viability, and capability for a surprise attack by orbital aircraft and makes the fulfilment of assigned tasks more economical, then we may consider that the development of such space weapons systems is a very good prospect.

However, air launches give rise to new technical and tactical problems, particularly the need to determine the best launch points and most favorable flight routes for mother-aircraft, to define the optimal flight conditions for orbital aircraft with due consideration to the developing situation, to select cosmodromes for landings, to provide support for landings; and others.

Orbital aircraft also have the capability of widening their target approach sector by maneuvering along the axis. Their considerable maneuver capability, especially when air launched, appreciably increases their probability of overcoming enemy antispace defenses and assures a wider choice of approach axes to the target.

Under combat conditions it may not always be expedient to approach the target from the first orbit. In order to mislead the enemy regarding their plan of action, orbital aircraft may be launched ahead of time and not proceed to their target from the first orbit. There can also be a variant in which an orbital aircraft is launched with the task of reconnoitering a specific target but can reconnoiter the entire area during its first orbits in order to refine the coordinates of the targets which are to be destroyed by ballistic missiles and space strike vehicles.

For fixed launch points and targets, each orbit has its own fully defined angles along the main and auxiliary axes of approach to the target. Therefore, the approach axis of an orbital aircraft can be changed depending on which orbit is selected.

In connection with the subject under review, attention should be drawn to the interesting possibility of making repeated approaches to an assigned target without loss of energy in maneuvering.

This is done in the following manner. At a given orbital inclination, the trajectories of two selected orbits have one point of intersection in the Northern Hemisphere and one in the Southern Hemisphere. This makes it possible to solve the problem in reverse--to calculate the flight conditions in which the trajectories of the two selected orbits will intersect at an assigned point of the target (given a fixed launch point). Repeated approaches to the target allow a strike-reconnaissance space aircraft to complete its target reconnaissance on the first orbit and to strike the target on the second, or a subsequent, orbit.

The nature of these conditions for fulfilling combat missions requires that the flight of a space aircraft be carefully prepared. The determination of the optimal launch points, the conditions of flight, and the approach to the target must be completed in a compressed time period, using electronic computers.

Of considerable importance is the capability of orbital aircraft to observe the earth's surface and targets on both land and sea.

The distance at which strike orbital aircraft can spot ground and sea targets is also of great importance, since it is this factor which assures that the strike weapons are dropped on target. For this reason, "space-to-earth" missiles must have a flight range assuring their reaching the target. In this case, space aircraft can destroy detected targets, above all, moving targets, without having to make a second approach.

For fulfilling reconnaissance missions with orbital aircraft flying in near space areas, it is not always feasible to produce equipment for surveying a large part of the area of coverage, since the scale of representation of the terrain will be small (1:1,000,000 to 1:3,000,000), allowing only a general overall reconnaissance of broad areas and large targets.

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At the same time, if the aircraft fly at low altitudes and have equipment to receive large-scale images, it will be possible to conduct reconnaissance of such important targets as cosmodromes, missile launch installations, carrier strike large units and their deployment, floating bases, elements of the antiaircraft, antimissile, and antispace defense systems, etc. The actual area coverage will be determined by specific reconnaissance equipment and the feasibility of installing several reconnaissance systems aboard orbital aircraft.

It must also be borne in mind that in fulfilling reconnaissance missions and mounting strikes whose realization demands the spotting and identification of ground targets, the extent of terrain coverage is limited by the angle of visibility attainable. The size of this angle is determined by the capabilities for interpretation, the distortions in the area and targets under observation, and the technical characteristics of the observation equipment.

In working out the problem of the combat use of orbital aircraft, consideration must be given to the duration of the observation of ground targets from the space aircraft and to the time the space aircraft is under observation from ground observation points.

At a flight altitude of 60 to 150 kilometers, the maximum duration of observation is three to five minutes. And if we consider that observation will not begin the moment the target (space aircraft) comes over the horizon and that the target may be to one side of the flight path, then the duration of observation will average 1.5 to 3.0 minutes; this will be reduced by half when rearward tracking is not available. Although observation time is thus limited, it is fully adequate for a cosmonaut to make an observation of the target. As regards transmission of information from a space aircraft to a command point, observation time can be significantly increased by an effective arrangement of receiving stations on our territory.

The above evaluation of the combat characteristics and capabilities of orbital aircraft leads to the conclusion that this type of aerodynamic vehicle is the future delivery vehicle for nuclear missile weapons and reconnaissance systems. Orbital aircraft are highly effective for conducting strategic and, above all, detailed reconnaissance of land and sea targets in areas which are inaccessible, or accessible only with difficulty, to strategic reconnaissance aircraft, such as areas at great distances or in which there are strong antiair defenses. Orbital aircraft may in some cases be called upon to perform operational reconnaissance missions in remote areas of theaters of military operations. Operational reconnaissance may also be carried out during regular strategic reconnaissance missions.

To assure rapid action against a newly detected target discovered during combat operations, orbital reconnaissance must fulfil its mission in close coordination with strategic strike weapons--intercontinental ballistic missiles, long-range aircraft, nuclear submarines, and orbital aircraft.

The choice of a strategic delivery vehicle will be determined by the nature of the target; its location; the time available; the condition of enemy antiaircraft, antimissile, and antispace defense systems; the combat readiness of our strategic strike means; and other factors. If it becomes necessary to mount a strike in a compressed period of time, orbital reconnaissance aircraft may fly in combat formation with orbital strike aircraft. In this case the mission of the reconnaissance aircraft will be to designate the target and guide the orbital strike aircraft to it. Action against targets spotted in coastal zones may be taken by nuclear submarines using data received from orbital reconnaissance aircraft.

In view of the maneuverability of orbital aircraft, their capability for independent actions, and their other combat features, it may be considered advisable to use them in the reconnaissance-strike variant as well, in which they will complete their reconnaissance (final reconnaissance) on one of their first orbits and strike their target on a subsequent orbit.

With their high combat capabilities, orbital aircraft can successfully fulfil missions for the destruction of nuclear attack weapons, military-economic targets, and enemy antimissile and antispace defenses; for combat with carrier strike large units; and for monitoring the results of actions conducted by other strategic strike means. The most favorable conditions for the actions of orbital reconnaissance and strike aircraft will obviously occur at low space altitudes between 60 and 150 kilometers, especially at altitudes of 90 to 120 kilometers.

Launching orbital aircraft on a calculated orbit will be the principal method for assuring that they reach the assigned area. In all probability, the majority of flights will consist of a single aircraft or a small group. In mounting massive strikes in coordination with other types of delivery vehicles, orbital aircraft will also be able to perform support functions. The nature of these support functions will be determined by their place in the overall structure of strategic forces. Thus, in missions to neutralize antimissile defense systems along the axes of flight of ballistic missiles, it is advisable to use orbital aircraft in the first echelon for striking enemy missile defense elements and, above all, for striking his most forward long-range observation points.

In addition to reconnaissance and the mounting of strikes, orbiting aircraft, in coordination with our "earth-to-space" and "air-to-space" antispace defense systems, can conduct combat with enemy space vehicles in flight, targets and space areas being assigned according to altitudes and zones of activity. In this case, orbital aircraft can carry out combat with enemy space vehicles at great distances from our territory which appreciably increases the possibility for using nuclear weapons.

Space interceptor aircraft which are piloted can successfully identify and intercept space targets, above all those which are operating at great distances from their own territory, distinguish the true targets from the false, and monitor the results of the actions of our other means of destruction of enemy space vehicles.

The presence of a cosmonaut aboard an orbital interceptor aircraft does not lower the demands for a high degree of automation of equipment, which must enable the pilot-cosmonaut to fulfil his functions with a high level of reliability: piloting; identification and selection of targets; and capture or destruction of targets. With automated equipment, the pilot-cosmonaut can carry out various tactical tasks, make the best decisions, use different types of weapons, depending on the type of target, handle the capture and removal of space targets if necessary, and rid a space area of false targets with a small expenditure of power. In order to increase the duration of their flights, orbital interceptor aircraft can reach altitudes of 150 to 200 kilometers and carry out intercepts at altitudes of 700 to 1000 kilometers.

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The solution of the problem of using orbital aircraft in combat brings to the fore the task of training flight and command personnel who have already had advanced operational-tactical and technical training. The strategic nature of the missions to be carried out, the global scale of the flights, the importance and complexity of fulfilling combat missions, the great responsibility of making decisions, the inherent nature of the working conditions of the crews of space flights, the presence of countless technical devices and instruments aboard space aircraft--all of these factors create pressing requirements for training the flight and command personnel assigned to work with space aircraft.

The use of piloted space aircraft requires the development of reliable radiation shields guaranteeing the safety of the crew during space flights. The greatest attention must be given to the problem of predicting solar flares in the chromosphere, which can cause a great increase in the natural radiation in areas of space surrounding the earth. In order to support space aircraft flights, we must set up a special service to produce reliable forecasts of the radiation situation in space.

The successful fulfilment of combat missions by space aircraft is unthinkable without resolving the problem of the development and establishment of a reliable control system which will ensure the assignment and monitoring of combat tasks; the collection, processing, and storage of reconnaissance and other information; and the launching and landing of space aircraft. At the command points, the situation in space must be represented in graphic form in order that it may be subjected to continuous evaluation.

In conclusion, it should be underlined that orbital and aerospace aircraft must carry out their combat missions in close coordination with all other strategic means, as well as with other types of space vehicles.

The creation of orbital aircraft will mark the beginning of space aviation, which, with its high combat capabilities, will further increase the combat might of our Air Forces and of our Armed Forces as a whole.