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Central Intelligence Agency

Washington, D.C. 20505

[redacted]

11 December 1987

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MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : USSR GENERAL STAFF ACADEMY LESSON: Military Use of Space

1. The enclosed Intelligence Information Special Report is part of a series now in preparation, classified ~~TOP SECRET~~, prepared in 1985 for use in the Voroshilov General Staff Academy.

25X1, E.O.13526

2. [redacted] this document should be handled on a strict need-to-know basis within recipient agencies.

[redacted]

Acting Deputy Director for Operations

[redacted]

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4462

Intelligence Information Special Report

[redacted]

COUNTRY USSR

DATE OF INFO. 1985

DATE 11 December 1987

SUBJECT

USSR GENERAL STAFF ACADEMY LESSON: Military Use of Space

SOURCE Documentary

Summary:

The following intelligence report is a translation from Russian of one of a series of lectures presented at the General Staff Academy. It is devoted to a general discussion of military applications of space, and the information it contains is at a very basic level. It defines three missions of military space systems and gives some of the basic concepts of how space systems operate. The development of the theme is rather anecdotal and general; a large portion of the details appear to be based on open western sources. There are several gaps in the text where entire passages are illegible.

End of Summary

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MILITARY USE OF SPACE

Of the total number of satellites in orbit, something on the order of 180 spacecraft with functioning equipment on board, 26 (or 12 percent) are research satellites, 24 (or 11 percent) are commercial, and three-quarters (73 percent) are military. In recent weeks our press, particularly Krasnaya Zvezda and Pravda, have carried reports dealing with space programs and about tests underway and in preparation. But tests are [rest of line illegible]. In order to be conducting tests of the complexity in question here requires an S&T lead time of 8-12 years, since what is going out to be tested has been under development for a long time.

Supporting systems include reconnaissance systems. This includes space-based ICBM launch early detection systems. These are also reconnaissance systems though they are sometimes set apart because they have a specific mission.

In order to carry out tasks to achieve the real objectives in a future war, the job of achieving these objectives, starting in space, is of paramount importance today, because it is through the use of space that they intend to achieve the goals of a conventional war as well. In efforts to achieve military superiority in space, to make use [of space], the following major groups of tasks are being carried out: first, shaping of military space doctrine; second, preparation of space as a future arena of combat actions; third, build-up of military superiority and build-up of space weapons capabilities. Since this build-up is taking place in all branches of the armed forces, control of the total number of these items is growing very, very difficult and, with the old organization, impossible. This leads to another task -- improvement of space weapons control systems to get the greatest return from them. In accomplishing these tasks, a whole group of additional, particular tasks are accomplished, in particular, global surveillance of space in real time in order to acquire an instant response capability. The task is to establish a permanent space presence -- which [the west] has already done -- and to ensure the effective functioning of space systems under war conditions. We shall return later to these particular tasks.

Building up a space weapons capability is a matter of introducing a new component, of building qualitatively new systems, and, in a word, developing experience with building these new systems. This already involves subissues or subprograms which [line illegible]. The tasks of developing space weapons, then, involves developing the weapons and mastering space as a zone of combat actions.

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The first and basic task, which our opponent is carrying out today by developing space weapons, consists in using space weapons for those missions of armed warfare which cannot be accomplished with other means. The second task is improving the effectiveness of accomplishing missions with traditional means, and the third task is mastering space. To these ends, development is taking place in different areas. For combat systems it is a matter of combating enemy spacecraft [3 words illegible] space defense; hitting the platforms and warheads, which is antimissile defense; and hitting strategic aircraft, which is air defense. The whole complex includes active means, space means for reconnaissance, navigation, communication, and [weather support].

When our opponents speak of further mastery of space and readying it for combat actions, they reveal a very typical feature [of their approach]: they begin with very awkward orbit altitudes. To date, principal attention has been devoted to near-earth space and in part to stationary orbits. But mastering of space is going on these days at very inconvenient altitudes -- 700, 800, 2,000, and 20,000 km, where it is inconvenient to put our spacecraft and awkward to carry on [2 words illegible]. It is this range which they are starting to master; and, in order to make this mastery of space and conflict in space more purposeful, their space-based means of armed conflict are given the following missions.

Space defense. This is the protection of one's own spacecraft from enemy interceptors. The first thing is to protect themselves, but at the same time they have a mission to knock out enemy spacecraft before and during a conflict and, in typical American fashion, to hit individual enemy spacecraft to effect sabotage, display determination, and buy prestige. The natural mission after knocking out key enemy spacecraft is to follow up with prevention of the reestablishment of enemy space systems during the conflict.

The missions of missile defense. We now refer to missile defense as having space-based components, which it quite clearly does. The first mission -- or rather, the first two missions -- are to hit intercontinental ballistic missiles and sea-based ballistic missiles in the active leg of their trajectories, i.e., at the time of launch before the engine stops running. If the flight trajectory is able to be altered or the engine operation can be [affected], the mission is essentially accomplished and the warhead will miss the designated target. When some of the missiles get through this battle zone, the first stage, the task of the system is then to combat warheads in the extraatmospheric portion of the trajectory -- as effectively, purposefully, and efficiently as possible, since today's missiles are MIRVed and a large number of warheads have to be taken out at once in the MIRV stage, not as such, but simply to ensure that they do not reach their targets. Finally, if these warheads or some of them make it through the extraatmospheric portion of the trajectory and start approaching the target area, the mission of missile defense will include target designation to ground-based means of missile defense to organize effective combat with them and

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support for local missile defense means which provide defense of individual installations.

And, finally, air defense missions -- hitting strategic aircraft, disrupting transport movements, etc. In addition to reconnaissance, weather, navigation, and communications satellites, American depictions of the use of space show space surveillance satellites -- our American opponents today regard it as [illegible] to place such space surveillance systems in orbits in the vicinity of the moon, either in front of or behind the moon, and monitor space from there -- and laser combat stations tasked with combating spaceborne targets.

Our opponents' portrait of the possible uses of space to achieve superiority also depicts ground-based means being used to combat space means. In order to show how they intend to carry out the task of combating our space means from the ground or with aircraft, we might take the following variant of the task. In July they intend to conduct a test launch of antisatellite missiles from an F-15.

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The United States is carrying out the following organizational measures to achieve more purposeful support and use of various space systems. In 1982 they established SPACECOM, the Air Force Space Command. It will be given all the forces and means that are to be under its aegis in 1985. Its domain includes a great many of the space [word illegible] system structures that the United States has today, in particular, the Aerospace Defense Center, the Joint Military Space Systems Control Center, a space monitoring and nuclear missile warning wing (in the communications directorate), and a shuttle space division is being organized. The basic tasks entrusted to the Space Command are development of doctrine and methods of conducting combat actions in space, coordination of [illegible], surveillance of Soviet space means, planning of space operations, and control of space means.

In October 1983 NAVSPACECOM was created. It was assigned to control [Navy] space means and it has assets to monitor space in the interests of the Navy. It is slightly different in that NAVSPACECOM is assigned the mission of control, while development falls under SPACECOM auspices. Thus, the Air Force and Navy have their own space commands. When the decision was made in 1982 to use space components for missile defense, it was also decided that part of the space means would be given to a ground forces space command, which was to take on the direction of the missile defense system, including the use of space-based components. Formation of the ground forces space command is slated for 1986, Withheld under statutory authority of the Central Intelligence Agency Act of 1949 (50 U.S.C., section 403g)

and it will incorporate a missile defense system, a missile defense range, and a center for development of [word illegible] missile defense means.

The diagrams show something not yet formed but only slated to be formed. Naturally the Joint Space Command, which is to be organized

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This is a revolutionary new concept not yet understood by persons accustomed to traditional thought. So there is nothing there, no offensive [word illegible]. This is no weapons system -- it is no system at all, it is not even a weapon. On the other hand, here is all this activity calculated to convince us that Star Wars and the Strategic Defense Initiative are so real that they are no longer subject to discussion or negotiation. The main thing they are pursuing now is to exclude the so-called Strategic Defense Initiative from negotiations and to conduct negotiations on all the other questions.

[Several lines illegible.] It is somewhat awkward to discuss this subject and the data I have are not official. The only thing I can say is that when the Americans were elaborating this whole complex of efforts, in a number of cases to justify the need for allocating resources for these aims, they would always trot out the argument that the Russians had already tested such a system, and they would cite specific examples. Concerning the use in space, let us say, of various means of destruction, we began this complex of efforts much earlier than the Americans, and we began them first in the sense of equipping space objects with laser means, laser weapons, and with ordinary rifled and artillery means -- ordinary projectile means -- that might perform these missions in space. And when experiments were conducted with space launches such as KOSMOS 1173, the Americans noted very precisely in their remarks that, after 1182 was launched and closed in with 1173, 1173 "no longer existed."

They issued two such publications and so this gives us something to compare. And they provided pictures of laser weapons systems and said the Russians had done this and that and they had to develop these efforts. [Part of line illegible] accelerated electron particles. In this respect, it should be said that efforts are going on which may ... [3 lines illegible]. In undertaking measures to ensure impunity in delivering nuclear strikes, the first thing that needs to be done is to take out our system of early detection of enemy missile launches. Therefore, the first thing they will do is take out this system. The second thing they will do is take out our space navigation system and ordinary reconnaissance satellites. The instant this process starts what will our reaction be? How will events develop? It is hard to say. The General Staff

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surely has algorithms to solve these problems; they deal with this matter. [Rest of paragraph illegible.]

When the last shuttle was orbited, it took along two spacecraft. One was very hard to separate. But it did not work, and so they wanted to bring it back, but failed. In order to ensure the operation of space systems today requires sending up a large number of back-up spacecraft that right now are cruising around as inoperative, with a well founded, convincing story for doing this. And when we read reports about inoperative spacecraft, we should be very sceptical of these reports because on cue these inoperative spacecraft can start operating and go to a different orbit and perform their functions. However, if we are persuaded that they do not work, [rest of line illegible].

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Looking further, one sees a number of coincidences. The Americans have published a booklet on UFOs [3 words illegible]. There is an example given there with photographs of a UFO which no one understands yet. It really is a flying object with the [typical form], some sort of cone with a sphere. When this information reaches one of our colleagues, he happens to learn that in a certain part of France there is a center that launches weather balloons, which is what the UFO turns out to be, as further inquiry reveals. [Rest of page illegible except for another reference to UFOs.]

And to date our opponents have begun building a backup network of space weapons. They have already started shaping and preparing it. I am not saying these are offensive space systems; communications and navigation systems are also necessary.

The creation and use of the navigation system of satellites is reaching the point where every asset, moving or non-moving, on earth, in the air, or in space can, with signals of this navigation system, determine its position with an error on the order of 16 to 20 meters. This is adequate for a great many tasks. But there is one hitch; with today's level of technology, to achieve such accuracy requires radio equipment to receive the signals and high-speed computers with the appropriate software. To obtain greater accuracy, these receive devices, computers, and software weigh on the order of 200-300 kg.

When speaking of this space navigation system, we are referring to the American Navstar system. It works from three points. It will include some 18 spacecraft circulating in orbits inconvenient for us at an altitude of 20,000 km. It is designed so that any object at any point on earth will have at least

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three satellites in its field of view. At each point in time the satellite is transmitting: My number is such and such; my coordinates are thus and so; [word illegible] time is this. The next moment it does the same thing, and so does each satellite. Information is obtained from three satellites in the field of view of the platform, of the ground-based or airborne object; the receivers pick it up on their own frequencies. Then it is sent to the computer, there is an algorithm, the initial data have been put in and the computer begins computations. The principle is quite simple. A fix made from two points gives plane coordinates; from three points, spatial coordinates. This is why three spacecraft are required. Six of these satellites have now been launched into orbit.

It is easiest to launch satellites into equatorial orbit, opposite the rotation of the earth -- this results in maximum speed and smallest expenditure of energy. From the reconnaissance point of view, it is not a high, but an ordinary low-altitude [orbit] that yields much information. We and the Americans both use equatorial orbits.

There is a second type of orbit. If a satellite is launched to pass over the poles, the orbit remains fixed in space and the earth beneath this orbit spins and continually presents the satellite a new aspect, so to speak. In this case everything is examined; the northern and southern polar caps are explored in great detail. But there is nothing to see there, which leads to the natural conclusion -- the inclined orbit. The angle is measured from the plane of the equator, say 60, 75 degrees, always from the plane of the equator. A 90-degree orbit is a polar orbit. But why a 97-degree orbit? The question has never been asked, but the answer may be as follows: Theoretically, when a spacecraft is launched into orbit, we are accustomed to regard its orbit except for altitude as unchanging, that is, the orbital plane does not change. But it turns out that, depending on the altitude and angle at which it is traveling, because of the irregularity of the surface of the earth and the unevenness of its gravitational field, this orbit begins to rotate in space; i.e., it is unstable. Depending on its angle, it rate of rotation changes. So that a reconnaissance satellite is located most of the time on the side of the earth illuminated by the sun rather than the night side, it is necessary to make its orbit turn along with the revolution of the earth around the sun, i.e., so that it is always in the sunlight. Such orbits are called sun-synchronous, and they are achieved when a spacecraft travels at an altitude of about 300 km at an angle of about seven degrees from the pole. Therefore the angle of these orbits is not arbitrary; this ±7 degrees from the pole is dictated by the answer to the problem of ensuring a sun-synchronous orbit, i.e., getting information mostly on the illuminated side of the earth.

When the spacecraft is launched, it is tilted to a polar orbit. It travels at an altitude of 300 km and makes one revolution in about an hour and a half.

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By the second orbit the earth presents its next swath. The equator is 41,155 km. An hour and a half is one-sixteenth of a day. Forty [thousand] divided by sixteen is 2500. [Two lines illegible.] The next swath is 2600 km away. We tend to think they are viewed uninterruptedly, but what happens is this. After a day it will get back to the first swath. The problem is always solved so as not to view the previous swath again but to orient the spaceship so that with a slight [overlap] it looks at the next swath, and in another day the one after that. Reconnaissance satellites travel at a minimum altitude on the order of 130-150 [km] and a maximum altitude of 300 to 450 km. The scan focal length is a meter or two, the close-up focal length is five or six meters. The scan width of a swath is 100-120 km, and the close-up width is 10-15 km. So with a 10- or 15-km width, it must cover the 2500-km swath 150 times to get everything.

Space reconnaissance systems are quite widespread today by virtue of four special features.

First, global presence. Space reconnaissance systems can carry on surveillance of objects at any point on the globe.

Second, the opportunity to do reconnaissance officially in peace- and wartime. When the Boeing flew over Kamchatka on us, what was our reaction? In the end it was [illegible]. And after this a protest was lodged. Now, the Americans, let us suppose, are building a new space object. When the first shuttle went by packed full of reconnaissance equipment, how much further could things be taken? What is going to be our response after the Americans have a successful launch of a new space object? We will send official congratulations on the successful launch, will we not?

Third, it enjoys great objectivity; the results are in documentary form and can be used repeatedly.

Fourth, it is very informative. In imaging reconnaissance, a scanning system in its active lifetime will acquire information from an area of 30,000,000 km^2, and a close-up system will obtain information from over 3,000,000 km^2.

Today all reconnaissance systems make possible or support the performance of the following tasks.

1. Detection of strategic objects and targets and determination of their coordinates.

2. Surveillance of the activity of detected objects and targets and confirmation of their [word illegible] and purpose.

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3. Detection of enemy radioelectronic means and determination of their coordinates, operating modes, and characteristics in order to organize electronic warfare.

4. Surveillance of everyday troop activity.

5. Surveillance of fleet actions.

6. Accumulation of information on the military/economic potential of the enemy.

7. Detection, or more precisely, early warning of a mass launch of enemy ballistic missiles.

8. Detection of enemy nuclear bursts and monitoring of our own nuclear strikes.

9. Weather reconnaissance.

All these tasks are performed by different means of reconnaissance. If one were to say more about this [illegible], they might be pictured as follows. Take the SAMOS reconnaissance system. SAMOS, an abbreviation of Satellite and Missile Observation System, performs special reconnaissance missions. Perhaps another year and this system will be taken out of service, since its principal disadvantage is that it does photographing on ordinary film, so that chemical, wet developing is involved, which has to be done on the ground. The film has to be shot on board, dropped to the ground, and developed there. The active lifetime is 120 days. If they wait till the end, all the information is old. These systems do not have the capability of getting reconnaissance information in real time. This is why they do not satisfy today's requirements and will be taken out of service.

Notice the altitudes of the orbit. The lowest is 110 to 140 [km] over our territory; over their own is is 330-415 [km]. This is so the lifetime of the satellites will be a bit longer. In one flight the capacity is 3,000,000 km^2; the information is dropped in capsules which descend by parachute.

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This part is being replaced by the space reconnaissance object [word illegible -- Big Bird?], or Low-Altitude Surveillance Platform. The active lifetime is eight months. It orbits at minimum altitudes of 150-180 [km] and maximum altitudes of 240-280 [km]. The angle is the same. These systems today provide simultaneous placement [in orbit] not only of this system but they put up small radio reconnaissance satellites and sometimes carry these satellites.

Let us take a look at the altitude at which weather satellites are placed. The Americans have always put them at an altitude on the order of 700 km. Development began some time ago; the first versions go back to 1976, and active use began a bit later. Keyhole-11 satellites appeared in orbit. The minimum altitude of the orbit is on the order of 250-300 km, and the maximum is 500-700 [km]. If the maximum altitude is 500-700 and the minimum is 300, you [would not think], on the basis of analysis of these characteristics, that this was a reconnaissance satellite. We were taught that detailed photoreconnaissance requires minimum altitude, and the altitude involved here is 300 km. So is this a reconnaissance satellite? No, they would not do that. They successfully took advantage of this for a year and a half or two years until our comrades obtained documentation on this Keyhole-11 and sent it here. Then it was learned that this was a brand-new reconnaissance device. And its [illegible] consists in the fact that it does automatic direction finding and transmission of information to ground stations in real time. The focal length of the lens with which it is equipped is 30 meters, which even in a television version makes it possible to obtain at the nadir a resolution of 15 cm on the ground.

If we speak of 15 or even 10 cm resolution, this does not mean they see an object of that size. To see and recognize an object, its image must occupy a minimum of 3-5 resolution cells. That is, the smallest dimensions of objects which this system will recognize [are] from half a meter up. This satellite is now one of the basic operational [surveillance] satellites.

They have now [illegible] transition to fully automated systems using so-called "mosaic" sensing elements based on charge-coupled devices, PZSes. The idea behind these devices ...

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... for a device from an altitude of 300 km to altitudes of 1000 km and even consider the possibility of transferring them to stationary orbits. This is one direction, and this part, the technological part, presents us a very real [problem?] -- charge-coupled devices. In this area we are behind. Single copies we can make, but series production we cannot do.

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The second direction I would direct your attention to is systems intended for early detection of mass launches of missiles by the infrared radiation of the engines. The process relies on use of the components of gasses in the plume of an operating engine. Every gaseous component when heated radiates energy, and it radiates selectively at a certain wavelength. And if this radiation enters an atmosphere which has the same components, these components [two words illegible]. This principle is very well [understood] and has begun to be used.

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... now have [two?]. One satellite hovers over the Indian Ocean, one over the Atlantic, one over the Pacific. The one over the Indian Ocean looks at all the territory of the Soviet Union. Those over the Atlantic and Pacific watch our submarines which can launch missiles from these areas. [Two lines illegible.]

The Americans also did work for a certain period of time on Midas satellites. Reports appeared in the press that the problem had been solved. A system had been worked out that made it possible to detect [word apparently missing]. This was an early detection system, an optical one. After some time a report appeared about a certain spacecraft equipped with such-and-such hardware; a specially allocated Titan missile was launched from a particular launch pad at a particular facility. It [the satellite] was supposed to detect the missile. This was advance notice. After this reports appeared claiming that the task was successfully carried out; the missile was detected. Now the task is to check this system when the launch is unplanned. That one was special, but this one would be unplanned. A certain time goes by, and there is an unplanned launch. The press reports that in view of the fact that the equipment did not expect the launch and that it was unplanned, Midas was unable to detect the launch, confusing it with a forest fire in Siberia and that for this reason, American scientists consider the development of this system unpromising and are directing their attention to developing radar-type space-based early detection systems. However, as I was just demonstrating, this system could not have confused [a launch] with a forest fire; at those wavelengths radiation does not pass through the atmosphere. But they placed this information in the press.

What was our response? Very simple. We had assembled good teams, associations, enterprises, and VUZes [institutes of higher learning] engaged in development. We began to disband these associations and convert them to other themes. With great difficulty our [VUZ] workers, who refused to listen, managed to preserve the thrust of the efforts -- to scratch our left ear with our right

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hand from behind our back. What would the American detection be like if it would perform these tasks?

Some time goes by and suddenly reports come out that the Americans are conducting tests of this equipment, that they have systems that provide early detection of a launch by the infrared radiation of working engines in the active portion of the trajectory. Like a bolt from the blue. What is our reaction now? It is a good thing that there were a few who refused to listen and the efforts continued. We built a system in time. The effort went on, the system works and does the job. Why am I relating this particular example? It is necessary to approach very critically the information they give out. They sometimes take advantage, as with Keyhole or other things. Take the shuttle, for instance, they threw everything out in the open -- here is how it will be, here is what we are doing, believe if you want. At first we did not [check on] the shuttle. In this case they did it the other way, [2 words illegible]; they [illegible] it very competently.

Sometimes we do not pay attention to the basic, first messages. But these determine the subsequent margin and the outcome of a weapons system.

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