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CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

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9 SEP 1952

MEMORANDUM FOR: The Acting Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (TOP SECRET): "American Military Technical Means of Combat in Space", by Major General of the Engineer-Technical Service P. Vysotskiy.

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.

2. For convenience of reference by USIB agencies, the codeword IRONBARK has been assigned to this series of TOP SECRET CSDB reports containing documentary Soviet material. The word IRONBARK is classified CONFIDENTIAL and is to be used only among persons authorized to read and handle this material.

3. In the interests of protecting our source, IRONBARK material should be handled on a need-to-know basis within your office. Requests for extra copies of this report or for utilization of any part of this document in any other form should be addressed to the originating office.

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Richard Helms
Deputy Director (Plans)

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Original: The Acting Director of Central Intelligence

cc: The Director of Intelligence and Research,
Department of State

The Director, Defense Intelligence Agency

The Director for Intelligence,
The Joint Staff

The Assistant Chief of Staff for Intelligence,
Department of the Army

The Director of Naval Intelligence
Department of the Navy

The Assistant Chief of Staff, Intelligence,
U. S. Air Force

The Director, National Security Agency

Director, Division of Intelligence
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Deputy Director for Research

Deputy Director for Intelligence

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Center

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COUNTRY : USSR

SUBJECT : MILITARY THOUGHT (TOP SECRET): "American Military Technical Means of Combat in Space" by Major General of the Engineer-Technical Service P. Vysotskiy

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Following is a verbatim translation of an article titled "American Military Technical Means of Combat in Space", by Major General of the Engineer-Technical Service P. Vysotskiy.

This article appeared in the 1962 First Issue of a special version of the Soviet military journal Voyennaya Mysl (Military Thought). This journal is published irregularly and is classified TOP SECRET by the Soviets. The 1962 First Issue went to press on 29 December 1961.

Headquarters Comment: Military Thought is published by the USSR Ministry of Defense in three versions, classified RESTRICTED, SECRET, and TOP SECRET. The RESTRICTED version has been issued monthly since 1937, while the other two versions are issued irregularly. The TOP SECRET version was initiated in early 1960. By the end of 1961, 61 issues of the SECRET version had been published, 6 of them during 1961.

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American Military Technical Means of Combat in Space 1.3(a)(4)

Major General of the Engineer-Technical Service

P. Vysotskiy

The first scientific-research work on the creation of military space devices for the conduct of special types of reconnaissance (photo reconnaissance and radiotechnical reconnaissance), as well as for the delivery of nuclear strikes from space against strategic ground targets using satellite missiles (snaryad-sputnik), were begun in the USA in 1946, while the creation of reconnaissance apparatus (television, facsimile television, photo locator, and radar) for earth satellites was begun in 1950.

Direction and coordination of this work was assigned to the U.S. Navy Department, with the participation of forces and means from the Department of the Air Force. About 50 large firms were called on to cooperate in the work at that time. In order to create military space devices and systems, the Americans needed data on conditions in space and their possible effect on satellites sent into space. In July 1955, the U.S. Government announced preparations for launching artificial earth satellites with a variety of scientific research apparatus during the 1957-1958 Geophysical Year. Preparations for the launchings were carried out in a unified program by the Defense Department, the Academy of Sciences and the U.S. National Committee for the International Geophysical Year. This project was designated "Vanguard". Responsibility for development of the carrier missiles, preparation of launching sites and launching of the satellites was placed upon the Department of Defense.

Fulfillment of the "Vanguard" program commenced in December 1957. However, the first attempt to launch a satellite into orbit proved unsuccessful. The "Vanguard-1" satellite was not successfully launched into space until 17 March 1958.

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This program was concluded in September 1959 and proved the most unsuccessful of the American space programs. As a result of 11 launch attempts, only three satellites were put into orbit, and they permitted the collection of only the most general data on the physical parameters of the outer layers of the atmosphere and of the space nearest the earth.

Failures in carrying out the "Vanguard" program forced the Americans hastily to work out the new "Explorer" research program on the basis of carrier-missiles, using "Jupiter" and "Thor" medium-range ballistic missiles as the first stages. (More recently, the specially created "Scout" research carrier-missile has been used for this purpose.)

The "Explorer-1" satellite, launched 31 January 1958, three months after the first Soviet satellite, became the first American satellite put into orbit around the earth. But this program also has not yet been completed.

In August 1958, the Americans proceeded to carry out the "Pioneer" space research program on the basis of carrier-missiles using "Jupiter", "Thor" and "Atlas" ballistic missiles as first stages, in order to study the physical parameters of space within the limits of the earth's orbit, as well as in the area of the moon and sun. But in this program also, not everything worked out successfully. Of the 9 attempted launchings, only two were crowned with success. The "Pioneer-4" and "Pioneer 5" space devices were, in the first case, put in orbit around the moon and, in the second case, in orbit about the sun.

Development of the first military earth satellites, and particularly the reconnaissance satellites of the "Pied Piper" project, continued simultaneously with preparations for the realization of scientific-research programs. In 1958, as a result of the lag behind the USSR and the numerous failures in satellite launchings, all space programs were reviewed in the USA and the decision was taken to expedite the creation of military space systems.

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On the basis of the "Pied Piper" project, three main projects for the creation of military reconnaissance satellites had taken shape by 1959: the experimental project "Discoverer" and the long-term experimental projects, "Samos" and "Midas", development and test launchings of which are being carried out at the present time. It was at this same time that intensive planning and development of other long-term military technical means of waging armed combat in space was begun.

At the present time, work in the creation of space weapons and space research means is being conducted on the basis of the program adopted in 1960 and designed for the period 1960 to 1975. A centralized governmental system of direction has been created for the fulfillment of the program. Responsibility for the development of military satellites has been placed upon the Department of Defense, and for the practical work, on the Air Force Weapons Systems Development Command. The National Aeronautics and Space Agency is responsible for work at the national level and for the fulfillment of a number of military programs.

The 15-year plan proposes the placing of about 970 space devices into space, of which about 570 will be of purely military designation.

At present, carrier-missiles and military space craft are being developed to accomplish the following basic tasks:

- the placing of light, medium and heavy research payloads and military space craft of various designation into space in various orbits;

- the support of various combat operations of all types of armed forces for the purpose of raising their effectiveness (military earth satellites);

- the conduct of armed combat in space and the destruction of targets on earth from space (carrier-satellites and space bombers with nuclear/missile weapons);

- the implementation of antimissile and antispace defense of the North American continent (satellites and maneuverable space craft).

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Let us examine briefly the projected military technical means intended for the conduct of armed combat in space.

Carrier Missiles. During the forthcoming 15-year period of exploration and mastery of space, it is planned that extensive use will be made of carrier-missiles which have already been developed and are currently in use, employing, as first stages, modernized "Thor" and "Atlas" ballistic missiles, with specialized second and third stages.

Such missiles include: - "Thor-Able", "Thor-Delta" and "Thor-Agena B". They are intended for placing 500 to 700 kg payloads into space. The weight of these carrier-missiles is about 50 to 55 tons, with a first-stage power-plant thrust of about 68 tons. The utilization of 210 such missiles is planned by 1975.

"Atlas-Able" and "Atlas-Agena B", intended for placing payloads of up to 1.6 tons into space in higher orbits. The weight of the carrier-missile is about 110 tons, with a first-stage power-plant thrust of about 170 tons. It is intended that about 590 such missiles will be used over the 15 years.

During the period 1963 to 1968, the Americans plan to conclude development and commence practical use of three new types of carrier-missiles, the "Atlas-Centaur", "Saturn" and "Nova".

The "Atlas-Centaur" carrier-missile will have as its first stage a significantly modernized and improved variation of the "Atlas" missile, and as its second stage, the "Centaur" missile, operating on liquid fuel (oxygen and hydrogen). The launching weight of this carrier-missile will exceed 110 tons, with a first stage thrust of about 176 tons. The thrust of the second-stage engines will be 14 tons. This missile will be able to put a payload of four tons in a 500-km high orbit, and deliver a payload of about one ton to the moon. The missile is now in the concluding stage of development and testing of its second-stage power plants. Practical utilization of the

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missile is planned for 1963, and it is intended that about 65 military and scientific-research space devices will be put into space by 1975, using this missile.

The "Saturn" carrier-missile is being developed in three versions, which are intended to place payloads of from 10 to 50 tons into space with a launching weight of 525 to 650 tons. The distinctive feature of this missile is that it is to be composed of five standard, unified stages, designated S-I, S-II, S-III, S-IV and S-V, which can be put together for C-1, C-2 and C-3 missiles in several variations to expand the ranges of payloads put into space.

The "Saturn C-1" carrier-missile has been under development since 1958, under the initiative of the Department of Defense and can have two- or three-stage versions.

According to project data, the first stage S-1 consists of 8 H-1 liquid-fuel rocket engines with 85 tons of thrust each. Its total thrust is 680 tons, length 24.5 meters and diameter 6.5 meters.

The second stage, S-IV, is a cluster (svyazka) of six L-10 liquid-fuel rocket engines with 6.8 tons of thrust each, operating on liquid fuel(oxygen and hydrogen). Thrust of the second stage is about 41 tons, length 15.2 meters, and diameter 5.5 meters. The third stage is a cluster of two RL-10 engines, with a total thrust of 13.6 tons, 16.2 meters in length and 3 meters in diameter.

The first launching of the "Saturn C-1" missile was carried out in October 1961, with a functioning first stage and dummy second and third stages. It is planned that 10 "Saturn C-1" missiles will be launched before 1964 as experiments. The Americans are expediting its development in every way. It is possible that the missile will be ready for practical use in 1964.

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According to calculations of the American specialists, the three-stage version of the "Saturn C-1" should assure the orbiting of space hardware of the following weights: 10-ton earth satellites in a 500-km high orbit, a 5.4-ton space craft in orbit around the moon, a 4.1-ton space craft in orbit around the sun and 6.8-ton "Dyna-Soar" aerospace craft (raketoplan) in orbit about the earth.

The "Saturn C-2" carrier-missiles (two- or three-staged) and the "Saturn C-3" (four- or five-stage) are considered more powerful than the "Saturn C-1" and will put loads of up to 50 tons into space. The completion of their development is planned for 1966 or 1967. The "Saturn" missiles are considered to be the basic American heavy missile, and the tentative requirement for them for fulfillment of military and research programs is 70 to 80 missiles.

The "Nova" carrier-missile is a five-stage system. It is to have a launching weight of 2100 tons, a first-stage power plant thrust of 2700 to 4000 tons, is to put a payload of 70 tons into a low orbit around the earth and 20 tons into 24-hour orbit, deliver a 12-ton space craft with three astronauts to the moon, and ensure the return of a 3-ton capsule back to earth. It is proposed that a cluster of four or six F-1 type engines, operating on high-caloric fuel and liquid oxygen, will be used as the first stage in this missile. It is proposed that a cluster of F-1 engines will be used as the second stage as well. Subsequent stages (possibly three more) will use engines operating on liquid oxygen and hydrogen. Test launchings of the missile are planned for 1966, and practical utilization beginning in 1968. It is planned that 20 such missiles will be produced for the 15-year program.

There also exist more long-term projects for the creation of carrier-missiles during the period 1970-1980. They include "Arcturus", "Antares" and "Aldebaran", which, according to American plans, should ensure an even more extensive mastery of space. Only a few estimated data are known about these carrier-missiles.

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"Arcturus" is designed to have a launching weight of 1,000 to 1,600 tons, with a first-stage maximum thrust of 1,360 to 2,000 tons.

"Antares" will have a launching weight of 4,500 to 9,000 tons and should be able to place a load of 1,100 to 2,000 tons in orbit around the earth and deliver a load of 900 to 1,800 tons to the moon.

"Aldebaran" is a single-stage cruise missile weighing 50,000 tons, equipped with an improved-type nuclear power plant, and is designed to place a load of 9,000 tons in orbit around the earth and deliver a load of 3,000 tons to the moon.

The designs for these carrier-missiles are, for the time being, based on very approximate calculations; test flights are projected for 1973 to 1980.

The present lack of powerful carrier-missiles, capable of putting large payloads into space, makes the Americans quite feverish and impedes their general progress in the mastery of space and the development of carrier-missiles. It is no coincidence, therefore, that governmental scientific centers and a number of the larger aircraft and missile construction firms are proposing the most varied designs, which, to a significant degree, encumbers the development of space means of combat.

In this connection, preliminary research under U.S. Air Force direction has been conducted and is continuing on the feasibility of creating a single, long-term complex of carrier-missiles for the universal accomplishment of the tasks in mastering space. This entire complex of work has been given the general designation: Project "Phoenix". By now, the optimum dimensions and configuration of the carrier-missiles have already been determined; methods of assembly, transport and launching have been refined; and problems in the creation of re-usable missile stages have also been studied under this project.

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Out of all the carrier-missile designs, 10 types have been selected, mainly using liquid-fuel rocket engines (zhidkostno-reaktivnyy dvigatel - ZhRD) which operate on liquid oxygen and hydrogen, and a turbo-pump system of fuel feed.

Under the "Phoenix" project it is proposed to create five basic modifications of two-or three-stage carrier-missiles, with a first-stage thrust of 220 to 1,330 tons, capable of putting 6.8 to 42-ton payloads into orbit around the earth.

While the cost of putting one kilogram of payload into orbit costs $10,000 to $100,000 using the early types of carrier-missiles, the average cost is $2,200 for the missiles which are used at present. Missiles created under Project "Phoenix" should lower the cost of delivery into orbit to $220 per kilogram of payload.

The high cost of delivery is caused by the one-time use of the first and second stages of the carrier-missile. Therefore, great attention is currently being devoted to the development of re-usable first booster stages. Thus the feasibility is being examined of creating boosters with a parachute recovery system possessing wings and control surfaces, which can be recovered by means of gliding in the atmosphere before landing, with turbo-jet engines assuring vertical landing, as well as boosters using turbo-jet engines as the primary engines. It will be possible to create such boosters by 1970.

Earth satellites of military designation for the support of combat operations. The development of a number of satellites of military designation has been in progress since 1957 and 1958. They are intended for the collection of intelligence information on objectives and targets on the territories of the countries of the probable enemy, intelligence on the activity of missile troops, for assuring precise radio-navigation, geodetic tying in of the nets of various continents and strategic targets to geodetic nets, as well as for providing uninterrupted and reliable radio communications for the control of troop operations and the receipt of timely and precise meteorological information.

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The basic military satellites, projected for practical utilization in 1962 to 1965, include the "Samos", "Midas", "Transit", "Advent" and "Rebound" satellites; the "Tiros", "Nimbus" and "Aeros" meteorological satellites; and the "Anna" and "Secor" geodetic satellites.

The "Samos" satellites are intended for reconnaissance of ground targets (Missile and airbases, major industrial enterprises, areas of troop concentration, fleets at sea, etc.) as well as of radio emissions from ground radiotechnical facilities. These satellites are put into polar orbit at an altitude of about 500 km by means of the "Atlas-Agena B" carrier-missiles. Photo-television apparatus, photo apparatus, as well as radio intelligence apparatus, can be installed within these satellites.

Photo-television apparatus serves for reconnaissance of ground targets. It consists of a photographic camera, automatic apparatus to develop the photographic film on board the satellite, and a television installation to transmit the image received on the photographic film to ground television receiver stations, where the images are reproduced on the television screen and photographed a second time to obtain a photographic intelligence document. It is considered possible to distinguish objects on earth with linear dimensions of 76 to 152 meters on the first photographs using this apparatus, which are transmitted from an orbit of about 500 km in altitude. It is possible to sketch only the most general picture of the enemy's territory on the basis of intelligence information received from such apparatus.

The Americans plan to utilize photo-television apparatus capable of revealing objects with linear dimensions of 2.5 to 3.5 meters for detailed reconnaissance of previously noted areas in the enemy's territory from the same altitudes.

The Americans give first preference to photographic apparatus, since, if it is of high quality, it can provide the photographing of large areas of the earth's surface during a brief period of time. However, in this instance it is

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necessary to return containers with photographic films from orbit to the earth in order to obtain the intelligence information. Therefore, the photographic apparatus is located in the body of the second stage of the carrier-missile, while the container for receiving the exposed photographic film is located in its nose cone and is equipped with a system for separation from the missile and a parachute recovery system. Development of the system for return and recovery of the containers is being carried out by the Americans in the "Discoverer" experimental reconnaissance satellites. Of 25 such satellites placed into orbit up to the present time, 11 containers with experimental reconnaissance apparatus and photographic film have been returned.

Photographic apparatus with a resolution capability "optical-film" on the order of 40 to 100 lines to the millimeter is being developed to equip the "Samos" satellites. The use of photographic apparatus with focal lengths of 30, 90 and 360 cm will permit the exposure on photographs of objects having linear dimensions of 0.7 to 18 meters when photographing from an orbit of about 240 km. To illustrate what this means, it can be noted that aerial photographs used during the Second World War which were taken from altitudes of about 9 kilometers could reveal objects with linear dimensions of 4.5 to 6 meters on the photographs. Therefore, the employment of high-quality aerial films, and cameras with large focal lengths, opens up great prospects for photographic reconnaissance from satellites. Thus, it is known that in 1960 "Lockheed" and a number of other firms were assigned the development of the "Samos E-6" photo-reconnaissance satellite, weighing about 1400 kilograms. It was planned to include up to 12 photographic cameras with various focal lengths and several types of photographic film of varying sensitivity in the satellite's complement of equipment. The containers with the apparatus and the exposed film are to be returned from orbit individually or in groups, using the recovery systems equipment. The SNAP-8 nuclear power source, generating 30 kw and destined to function for one year, is being developed to power the equipment on board the "Samos".

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In order to decipher the great volume of information received from the satellites, high-speed electronic computers are being developed which should rapidly reveal objectives and targets, compare them with similar images, identify the nature and purpose of the objectives, and produce printed and graphic information about them which is suitable for utilization by the armed forces. Five C-130 "Hercules" military transport aircraft are being re-equipped at the present time to pick up photographic containers being returned from "Samos" satellites.

Reconnaissance radar sets, which would be capable of making satisfactory identification of major military and industrial objectives from altitudes of about 400 km, are also being developed to be installed on board the "Samos" satellites.

During the period 1960 and 1961, the Americans attempted four times to launch "Samos" satellites, but were successful in placing only two in orbit (with an effective period of service of about one month). Design work on the "Samos" is being carried on extremely actively by the Americans. They hope to obtain data, by means of these satellites, primarily on the disposition of intercontinental missile-launching mounts and air bases of strategic aviation. However, because of the complexity of the problem, the Americans were unable to fulfill their projected plans for 13 launchings during 1960 and 1961. For 1962, 20 "Samos" satellite launchings are envisaged by the plan, and subsequently 6 to 8 satellites are to be put into orbit annually for periodic reconnaissance of targets in areas of the enemy's territory which are of interest, and particularly in the arctic areas of the Soviet Union.

The "Midas" satellites are intended for reconnaissance of nuclear/missile strikes against U.S. territory while they are being carried out, with 25 to 30 minutes early warning before the missiles reach their designated targets. Ballistic missiles should be detected by the "Midas" satellites, 1 to 2 minutes after launching, by the intensive thermal radiation of their power plants during the active sector of the missiles' flight trajectory. The "Midas" satellite system is, therefore, more

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advanced than the system of radar stations for ultra long-range detection of missiles, which permits the detection of missiles only after they rise above the line of the horizon and enter the zone of the beam of the radar stations. The possibility of detecting ballistic missiles at an effective range of 16,000 to 24,000 km, when their strike may be directed at the U.S. by way of the Southern Hemisphere, where there are no ultra long-range missile detection radar posts, is considered to be another advantage of the "Midas" satellite system.

On board each "Midas" satellite there is an infra-red scanning mechanism, for detection of the fact that a missile has been launched (either individually or a mass salvo of missiles). The receiving element of this mechanism (in one of its experimental models) is sensitive to radiations in the wave band of 10-100 microns, and possesses selectivity which permits it to distinguish infrared radiations of intercontinental missile engines from emanations of other ground heat sources (blast furnaces, coke-conversion combines, forest fires, etc.).

On the basis of data from the scanning mechanism, the satellite's computing equipment must determine the missile's approximate direction of flight and the area against which the strike is delivered. These data and the alarm signal from the satellite go to a data-transmitting radio apparatus, then to special ground posts for observation of the satellites and the receipt of information. It is also considered possible subsequently to transmit the information from the satellites to ground receiving points through a network of special active communications satellites, which are being developed in the "Courier" and "Advent" projects.

A network of 20 "Midas" satellites, moving in orbits with an apogee of 2,500 km and a perigee of 320 km, will have to be created in order to provide uninterrupted observation of the enemy's territory.

The "Midas" satellites have been under intensive development by the Americans since 1958. "Midas" satellite launchings commenced in 1960. In all, 4 launchings were carried out and 3 satellites were placed in orbit. It is known, for example, that the "Midas 4" satellite detected the experimental launching

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of an American "Titan" ballistic missile two minutes after launching and transmitted the detection signal to earth. According to the estimate of the Americans, in spite of the intensive work, fulfillment of the "Midas" project is lagging about 10 months behind the planned schedule. The launching of 10 satellites annually with an effective duration of more than a year is envisaged for the period 1962 to 1965, according to the "Midas" satellite-launching program, drafted for 15 years.

The "Transit" radio-navigational satellites are intended by the Americans for the precise navigation of vessels and aircraft, and primarily for the existing missile-carrying submarines armed with "Polaris" missiles, and strategic bombers carrying "air-to-surface" class "Hound Dog" and "Sky Bolt" missiles. It is known that at the present time there exist a multitude of autonomous and non-autonomous(operating jointly with ground apparatus) navigational systems. However, they provide precise navigation only in equipped areas and require constant correction of their readings.

In turn, non-autonomous navigational systems, even those providing high precision in fixing coordinates, are considered by the Americans to be vulnerable, for even if only one station is put out of commission by the enemy, the system is rendered practically useless. The utilization of such systems to fix the launching point for "Polaris", "Hound Dog" and "Sky Bolt" missiles is considered unreliable as well. According to American calculations, the "Transit" satellites should fix coordinates for vessels or aircraft with an accuracy of about 200 meters.

Moreover, the Americans consider a system of radio-navigational satellites to be invulnerable because the means to combat such satellites have not yet been created.

The operating principle of the system, which consists of 6 or 8 satellites, is the following. The satellite, with a complex set of radio-electronic apparatus on board (a high-stability radio transmitter, a recording mechanism, a transmitter of the parameters of the satellite's orbit, and source of power) is placed in a calculated circular orbit at an

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altitude of 700 to 900 kilometers. The satellite's ground control station measures the precise parameters of its orbit once every 24 hours and transmits them to the satellite, where they are recorded on magnetic tape. Simultaneously, time adjustment signals are sent to the satellite. While moving in orbit, the satellite transmits to earth, at intervals of 1 to 2 minutes, a signal from its stable transmitter, data on the parameters of its orbit and signals of standard time. On the basis of all these data, the vessel or aircraft receiving-measuring and computing apparatus calculates the precise coordinates of the location of the vessel or aircraft. The precise coordinates of the location just before missile launchings of missile-carrying submarines (in submerged position and receiving the "Transit" satellite signals on a trailing antenna, fixed to a buoy), or a carrier bomber, are fed into the computer apparatus of their flight control system and serve as the initial data in firing against the selected targets.

"Transit" satellites have been under development by the Americans since 1957. These were the very first satellites intended for the creation of a radio-navigational net operating in actual practice. Of the seven satellites launched in 1960 and 1961, five were put in orbit. The last of them, "Transit 4A", is equipped with a "SNAP-3" nuclear reactor, which will provide electric power for the radio-technical apparatus on board for a period of one year. It is considered that it fully meets the necessary requirements in its tactical-technical characteristics.

It is planned that 12 such satellites will be put into space in 1962 and 1963. An operating network of them should include six satellites, of which four are to be put into circular orbits with an angle of inclination of the planes of their orbits to the equator of about 67°, while two are to be put into circular equatorial orbits at an altitude of 700 to 900 km. It is planned that 114 "Transit" satellites will be put into space in 15 years.

The "Rebound" and "Advent" communications satellites are intended for a global radio communications net, which will provide control of the combat operations of all types of armed

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forces and primarily for the strategic attack weapons of the USA.

It is known that the Americans are striving to develop reliable radio communications means in order to bring, primarily, strategic aviation, intercontinental ballistic missiles and submarine missile carriers up to combat readiness, and to control their combat operations. For this purpose, in addition to the creation of a global communications net, the Americans are conducting work on the search for radio communications means for control under exceptional conditions, using high-altitude missiles of the "Tattle Tale" project, and are also studying the feasibility of creating passive communications satellites and passive reflecting belts, located in orbits around the earth, and active communications earth satellites.

The "Tattle Tale" project envisages the creation of a battery of high-altitude missiles, which are to be lofted to an altitude of 1,600 km, carrying transmitting and relaying apparatus, when the normal functioning of other means of control has been disrupted. It is to transmit to command posts of all types of armed forces instructions to bring them up to combat readiness, and combat orders for the commencement of combat operations.

The utilization of communications earth satellites is considered a long-term prospect. Two varieties of communications satellites are being developed for these purposes: the passive, which reflect signals sent to them from transmitting to receiving points, and active, containing receiving and transmitting radio communications apparatus on board, which provide for the relaying of communications sent to the satellite from the transmitting to the receiving points. Depending on the height of the orbit, such satellites can provide ultra-short-wave communications at distances of thousands of kilometers, which will make it possible to dispense with the use of numerous earth relay stations, which are complex to build and are expensive.

The first experimental passive satellite was the "Echo 1", launched into space in 1960 and currently in orbit. It provides periodic radio communications between the east and west coasts

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of the USA, as well as between the USA and the countries of Europe. In appearance, this satellite is an inflated globe, 30 meters in diameter, manufactured from thin film, and covered with a thin layer of aluminum paint in order to increase its capacity to reflect radio waves.

A shortcoming of this type of satellite is, nevertheless, its low radio-wave reflecting capability, which necessitates the construction of great antenna systems at transmitting and receiving points, capable of automatically tracking the satellite during flight, in order to create reliable radio communications lines.

Work on the "Rebound" project is being carried out in this connection. The "Rebound" satellites will also take the form of inflated structures, but of lesser diameter, and in order to increase the reflection of radio waves, their outer surface will be filled out in the form of numerous conjugate corner reflectors (sopryazhennyy ugolkovyy otrazhatel). The launching of about 46 such satellites is planned for the period 1962 to 1965, but according to estimates of the Americans, even they will not accomplish the tasks of creating global radio communications nets.

For two years the Americans tried unsuccessfully to create an artificial reflection belt around the earth (in polar orbit) out of metallic reflecting dipoles. At first, the project for the creation of an artificial reflection belt bore the designation "Needle", but afterwards the designation "West Ford". This project envisages placing in orbit a satellite with a container holding reflecting dipoles, which, when distributed along the orbit, will create a reflection belt for radio waves and will be able to provide uninterrupted radio communications, particularly in arctic areas.

An attempt to create such a belt was undertaken with the launching in October 1961 of the "Midas 4" satellite, within which a container with dipoles was installed. Because of a series of malfunctions, the dipoles were not successfully dispersed along the satellite's orbit. It should be noted that

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this attempt bore an experimental character, and the Americans themselves had little faith in the possibility of organizing reliable radio communications by this method. Most probably this was a diversionary maneuver in connection with the "Midas 4" launching.

The more promising satellites for these purposes are the active communications satellites. Three projects ("Courier", "Decree" and "Steer") were being developed for the U.S. Army, Air Force and Navy as experimental models of such satellites, but since 1960 they have been replaced by a single, overall long-term project called "Advent", the development of which will take place in three stages.

For the first stage it is proposed that satellites weighing about 450 kg will be created in order to carry out communications in the 1700- to 2400-megacycle frequency range on ten channels, with a transmitter of about 1 watt power and a transmitting antenna 50 cm in diameter.

For the second stage, it is planned that satellites weighing about 1,360 kg will be created to contain about 490 kg of communications apparatus. Communications will be carried out on the frequency band of 4400 to 5000 megacycles, with a transmitter output power of 5 watts. This apparatus is calculated for communications on six channels, with each channel having a band width of 100 megacycles. Each broad-band channel can be used for the transmittal of encoded information on 100 telephone channels, and on 1,000 telephone channels for non-coded.

For the third stage, satellites weighing up to 2,000 kg, destined for 24-hour orbits, will be created. The apparatus of these satellites will be calculated for operating on the 5,000- to 10,000-megacycle frequency band. These satellites will be equipped with inflatable parabolic antennas up to 6 meters in diameter. Miniaturized nuclear power sources are being created in order to extend the period of service of these satellites.

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It is planned to place "Advent" satellites in orbits up to 36,000 km in altitude by means of "Atlas-Centaur" and "Saturn" missiles. Two experimental "Advent" satellite launchings were planned for 1961, but this schedule was not maintained. Two experimental satellite launchings a year are planned for the period 1962 to 1964, while the creation of a global net consisting of three satellites in a 24-hour equatorial orbit will take place in 1965, using a "Saturn" missile, which is supposed to be ready for practical use by that time.

The "Nimbus" and "Aeros" meteorological satellites are intended for the creation of meteorological nets for weather reconnaissance in various areas of the globe for the purpose of precise weather predictions in support of all types of armed forces.

The first meteorological satellites were "Tiros" satellites, equipped with two television cameras capable of transmitting cloud-cover images to ground reception stations for one year. On earth, meteorological maps were compiled on the basis of these data, making it possible to determine the distribution of wind velocities at various altitudes, and of storm centers and the direction of their movement along the earth's surface. A great quantity of meteorological data were received from the three "Tiros" satellites placed in orbit during 1960 and 1961, for the analysis and processing of which attempts were made to utilize electronic computers. "Nimbus" and "Aeros" satellites with television, infrared and radar apparatus on board are being created in order to create a constantly functioning net of meteorological satellites. It is planned to put "Nimbus" satellites in orbits of about 1,100 km in altitude and the "Aeros" satellites with improved television cameras in 24-hour orbits. In all, it is planned to launch about 60 satellites of this type during the 15-year period.

Data received from the satellites will be processed by the use of electronic machines and will be transmitted to interested headquarters.

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The "Anna" and "Secor" geodetic satellites are intended for more precise determination of the earth's shape, for geodetic tying in of points situated on various continents and of geodetic nets, particularly the nets of the USSR and USA, by the spatial triangulation method, as well as for the tying in of strategic targets to these nets with an accuracy of 10-30 meters, for operations against them by nuclear/missile weapons of attack.

At the present time, two types of geodetic satellites are being developed in the USA: optical (Project "Anna") and radio range-finding satellites (Project "Secor").

The development of satellites in the "Anna" project began in 1958. It was proposed that by the end of 1960, satellites would be created weighing 50 to 68 kg, and 90 cm in diameter, equipped with sources for intensive light radiation, and which could be photographed against the background of stars, and on the basis of these photographs make a geodetic tie in of nets and targets, using astronomic calculations. The pulse light source is calculated for the formation at two-minute intervals of light flashes with a duration of 1 millisecond and with an intensity of 320 lumens per second. It was also proposed to install in the satellite a pulse-operating radio beacon with the same frequency and duration for automatic tracking of the satellite in the celestial sphere.

In connection with the fact that the development of this satellite was not completed in time, the program for the creation of geodetic satellites was reviewed at the end of 1960, and in view of its direct military significance, the responsibility for its fulfillment was placed on the Department of Defense.

The operating principle of the "Secor" radio range-finding system is based on the use of the method of sequential comparison of distances from four radio range-finding stations on earth to the radio satellite located in an orbit, the parameters of which are known. The component elements of the system will be: three ground air-transportable stations, equipped with special radio-ranging installations and located at points with known geodetic coordinates; a ground station which will be located at a point which can be tied in to a known geodetic net; and a satellite with the transmitting-receiving radio apparatus.

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The "Secor" system is to provide a range of operation (measurement of distance between points) of up to 16,000 km and operate on a frequency band of 482 to 512 megacycles. Ground transmitters are calculated for an emission power of 500 watts at a frequency of 512 megacycles. The ground receiving stations will operate on frequencies of 482 megacycles.

Experiments with the "Secor" equipment are being carried on simultaneously with launchings of "Transit" radio-navigational satellites, on which the appropriate testing apparatus has been installed.

The Americans propose to create portable units of ground apparatus which can be transported, as well as a unit of miniaturized apparatus for the fourth of the stations, which is intended for secret installation in the area of the target and which must be tied in to the other three stations. Such an apparatus can be thrown from a plane in the areas of the targets which are to be tied in.

The expected accuracy of distance measurement by such a system is about 0.5 meters.

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A number of major American firms and the Weapons Systems Development Command are conducting planning work on a broad front for the creation of offensive space bombing systems designed to destroy ground targets from space. It is considered possible to create such systems only after 1970.

It is proposed that automatic carrier-satellites and piloted space-carrier-bombers will be included in this system.

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Carrier-satellites for nuclear/missile weapons are being studied and designed under the general program, NABS. At present three projects under this program are known.

The first project, PCB, envisages the creation of carrier-satellites for "space-to-surface" type missiles for the destruction of ground targets.

It is proposed that three-ton carrier-satellites will be placed in an orbit 185 km high, with an orbital period of 90 minutes. At this flight altitude, the carrier-satellite will be within the limits of direct visibility from ground control stations for 18 minutes, from where commands can be issued for launching "space-to-surface" missiles. Depending on the size of the angle of direction of the launch in relation to the tangent to the orbit, it is considered possible to destroy targets at distances of from 9,000 to 30,000 km from the läunch point. The weight of such a missile with a nuclear warhead can exceed one ton.

The second project, SLOB, envisages the creation of bomber-satellites for bombing ground targets with nuclear charges. It is proposed that such bomber-satellites will be placed in what, by American definition, are considered low orbits, at an altitude of up to 36,000 km, i.e. up to stationary, 24-hour orbits.

The third project, SHAOB, envisages the creation of bomber satellites for the destruction of ground targets with nuclear warheads from altitudes exceeding 36,000 km.

Piloted space carrier-bombers for nuclear/missile weapons are being studied and designed under the general program, "BOSS-10C". This program includes two basic projects: "Dyna-Soar" and "BOSS-10C". It envisages a feasibility study on the creation of non-combat space systems, of piloted combat systems, as well as of systems for support of the conduct of combat operations in space.

The "Dyna-Soar" project envisages the creation of experimental piloted glide or orbiting bombers "Dyna-Soar-1", which have a calculated flight range of 40,000 km when brought to a height of about

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160 km by the modernized "Titan-2" carrier-missile. This experimental glide bomber, with a crew of two men and a flight weight of 6.8 tons, will subsequently, according to American opinion, be the basis for the development of the piloted orbiting bombers, "Dyna-Soar-2", "Dyna-Soar-3" and "Dyna-Soar-Mouse", which will be maneuverable space vessels weighing 6.8 to 10 tons.

In turn, on the basis of any of these, the Americans expect to create a space bombing weapons system for the destruction of ground targets with nuclear/missile weapons. Experimental gliders are already being created under the "Dyna-Soar-1" project at the present time. Later on, in 1964 and 1965, it is proposed that test and practical models will be built for flights in space with a crew on board. It is planned to carry out 24 flights over a period of 15 years, using "Titan 2" and "Saturn" missiles. Flights of "Dyna-Soar-2" have not yet been planned under this project, but "Saturn" carrier-missiles will be used to carry them out.

It is also known that the U.S. Air Force proposes, on the basis of the "Dyna-Soar" project, to create a maneuverable space reconnaissance vehicle with a crew of three men for the reconnaissance of ground targets, for the design of which a competition has been announced. According to the U.S. Air Force tactical-technical requirements, the reconnaissance vehicle must be placed in polar orbits at an altitude of about 400 km, with the capability of maneuvering to lower orbits of 160 km for detailed reconnaissance of ground targets. It is envisaged that optical, photographic, television and radar apparatus will be used as reconnaissance equipment. It is considered advisable to process the intelligence data on board the vessels and transmit it to earth. The task of creating such reconnaissance means is to be performed by 1966.

The "BOSS-10C" project envisages a study of the feasibility of creating bombing systems to operate at altitudes of about 36,000 km. It is divided in turn into two sub-projects with the designations P-79821 and P-79822.

The sub-project P-79821 envisages a study of the feasibility of creating piloted and automatic armed or reconnaissance space systems. Three versions, which have been designated A, B and E, are being studied. They will use ballistic or glide re-entry into the atmosphere and are destined for operation at altitudes

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of less than 1600 km. The designing of bombing weapons systems suitable in practice for operations at the indicated range of altitudes is being proposed on the basis of more realistic and long-term research.

The sub-project P-79822 envisages a study of the feasibility of creating piloted and automatic armed or reconnaissance space systems for the conduct of combat operations in the altitude range of 1,600 to 36,000 km. Two versions, designated C and D, are being studied, using ballistic or glide re-entry into the atmosphere. The practical design of a final version of the "BOSS-10C" piloted bombing system for the conduct of combat operations in the altitude range of 1,600 to 36,000 km is proposed on the basis of one of the more realistic versions.

It should be noted that all the projects for space bombing systems are in the very initial stage of study and research, with the exception of "Dyna-Soar", but certain of them are already being financed by the Government.

The development by the Americans of military technical means of combat in space shows that the imperialists are using technical progress mainly for military purposes and are preparing to turn space into an arena for destructive war.