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The Fundamentals of Antimissile Defense

(From foreign sources)

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Under the conditions of a nuclear/missile war, reliable antimissile defense, as a factor of strategic significance, is becoming one of the most important conditions for the successful conduct of a modern war.

The development of defensive weapons takes place in dialectical unity with the development of attack weapons. A comprehensive study of the characteristics, potentialities, and direction of the future development of ballistic missiles must be the basis for the correct resolution of questions of the organization of combat against ballistic missiles.

The basis of an aerial attack on objectives of the country consists of attack weapons of strategic designation, which in the USA are divided into three basic groups in accordance with their flight-technical characteristics:

-- aerodynamic aircraft;

-- ballistic missiles;

-- cosmic devices.

The second group is the most promising and rapidly developing. Here the main efforts are being directed toward the production of long-range missiles as the main striking force. The share of missiles' participation in the performance of the tasks of aerial attack will increase with every year, and in the near future, the ballistic

missiles in the enemy's arsenal of attack weapons will assume the leading role. The armed forces of the USA are equipped with ballistic missiles of various classes and various ranges of operation. 50X1-HUM The intercontinental missiles, "Atlas", "Minuteman" and "Titan", are intended for delivering strikes against objectives located at a distance of 10,000 to 16,000 km, the intermediate-range missiles, "Jupiter", "Thor" and "Polaris", - for objectives located up to 2,000 to 3,500 km away and the short-range missiles, "Pershing", "Redstone", and others - against objectives at a distance of up to 350 to 550 km.

In the USA work is being conducted on the creation of ballistic missiles of the "air-to-surface" class. Specifically, it is intended to arm the B-52, "Victor", and "Vulcan" strategic bombers with a missile of this class, the "Sky Bolt".

At the present time the strategic missile attack weapons of the potential enemy are deployed in the continental part of the USA, and also on the territories of their allies in the aggressive blocs. In the USA, 65 launching sites for intercontinental ballistic missiles have already been built; by 1965 it is planned to increase their number to 860 launching mounts. On British and Italian territory there are 90 intermediate-range missile launching sites deployed; the construction of 15 launching sites is being completed in Turkey. There are 5 atomic submarines armed with "Polaris" missiles on combat patrol.

Thus, an analysis of trends in the development of weapons of strategic attack and in the proposed deployment of the probable enemy's missile bases permits one to conclude that in the future the basic means of strategic attack will be intercontinental ballistic missiles deployed on the territory of the United States of America, and intermediate-range missiles, the launching sites of which are located around the Soviet Union and the countries of the

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peoples' democracies.

Missile-carrying submarines, missile-carrying aircraft, and strategic bombers will be the maneuverable weapons.

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An effort to use force against the elements that make up the national might of the probable enemy is the basis of the official American aerospace doctrine. The first task of aerospace operations is undermining the nuclear/missile might of the Socialist Camp in order to disrupt or weaken to a significant degree the strength of our missile strikes. Simultaneously with the performance of the main task, it is planned to deliver strikes against the most important administrative-political and military-industrial centers and other objectives, with the goal of disorganizing the control of the country, disrupting the mobilization of troops, and undermining the military-economic potential and morale of the people. A nuclear/missile attack must be massive, and be carried out using the element of surprise and in a short period of time. It should be assumed that the most powerful first ballistic missile strike will be organized so that the missiles of various ranges of operation will enter the zone of detection of the antimissile defense means at the same time.

For this reason the antimissile defense can successfully perform its tasks if its structure takes into consideration a capability for repulsing the first nuclear/missile strikes of the initial period of war which are carried out by the enemy with the use of various countermeasures directed toward reducing the effectiveness of the defensive weapons.

The nature of nuclear/missile war, with its decisive goals and unprecedented spatial scope, makes antimissile defense the most serious task of the present day.

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Success in combat with ballistic missiles can be achieved by the joint efforts of all types of armed forces. Disruption of enemy nuclear/missile strikes can be accomplished by destroying ballistic missiles which are ready for launching on launching sites, as well as by destroying them in flight.

We understand antimissile defense (PRO) (protivoraketnaya oborona) to be one of the methods of armed combat, directed toward the protection of the country and its armed forces from an enemy missile attack by means of destroying ballistic missiles in flight.

Combat with ballistic missiles in flight is a complex military-technical problem. In order to realize all its difficulty it suffices to say that in PRO it is necessary to deal with insignificant targets, as far as size and reflecting surface are concerned, flying at enormous altitudes and at cosmic speeds. Thus, for example, the nose cone of an "Atlas" missile, in the centimeter wave band, has a reflecting surface of about 0.5 square meters, a maximum flight speed of more than 25,000 km per hour, and a maximum height of the trajectory of 1,300 km.

This problem can be made even more complex by the enemy if a series of measures that complicate detection, interception and destruction in flight are taken into consideration:

1. The launching of ballistic missiles under quadrant angles of departure that are less than the optimum, which leads to a reduction in the range of detecting them by the means of the PRO.

2. The employment of dummy targets which lower the probability of destruction of the nose cones of the ballistic missiles.

3. The reduction of the reflecting surface of the nose cones of the ballistic missiles by using various materials that absorb radio signals.

4. The use of special transmitters for creating active interference with the PRO radiotechnical equipment, including those that are located in the nose cone of the ballistic missiles or are ejected in containers.

Based on the nature of antimissile defense, the tasks of PRO are:

-- detection and recognition (raspoznavaniye) of ballistic missiles;

--destruction of ballistic missiles in flight;

-- immediate warning of the military command and the civil defense of the start of an enemy missile strike;

-- detection of artificial earth satellites.

Antimissile defense as a whole, like anti-air defense, must satisfy a series of requirements, the basic ones of which are constant readiness to repel an enemy missile attack, high effectiveness and stability.

Consequently, the construction of antimissile defense must be carried out simultaneously in two interrelated directions. One of these is the creation of a system of means for combatting ballistic missiles in flight, the other is the elaboration of the theoretical principles of employment, combat utilization and organization.

In principle, the destruction of missiles is possible both in the initial, active sector of the flight and in the final sector of the trajectory.

However, research shows that at the present time, the creation of means of antimissile defense capable of destroying missiles in the passive sector of the flight, before entry into the dense layers of the atmosphere, is most realistic.

In the opinions of foreign specialists, at the present time an antiaircraft missile complex specially created for antimissile defense, with a guided antimissile missile can be an effective means for combatting ballistic missiles. Such an antimissile complex must:

-- detect the ballistic missile at a considerable distance from the area being covered and determine the elements of the trajectory of its flight;

-- pick out the nose cone against a background of dummy targets;

-- carry out the placing of the antimissile missile on the plotted flight trajectory of the ballistic missile and secure, with the necessary accuracy, the approach of the antimissile missile to the nose cone;

-- destroy the nose cone of the ballistic missile.

The total time during which an antimissile complex must fulfil its mission is only a few minutes; therefore all its operations must be fully automated. From the technical standpoint the PRO complex must be an aggregate of radar sets, ground equipment, the control system, the antimissile missiles, and computing devices.

The structure of the organization of combat with ballistic missiles may be examined from the example of the "Nike-Zeus" antimissile system that is being developed in the USA.

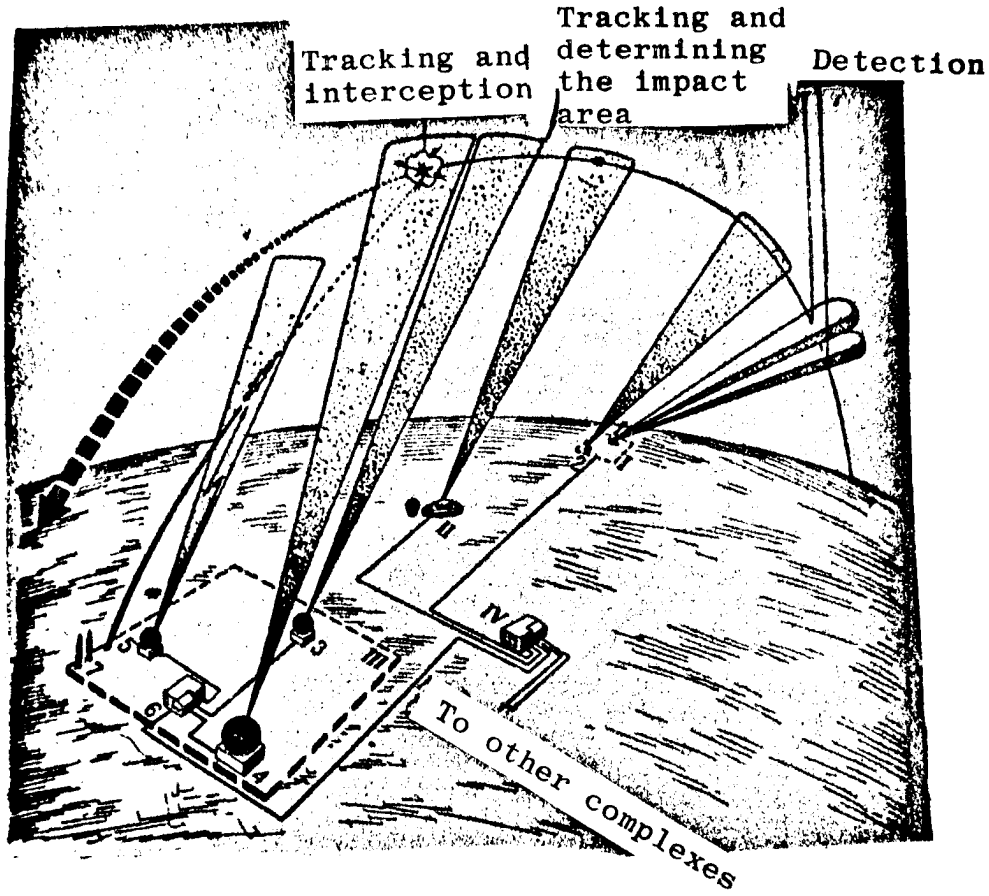

Diagram 1. Structural diagram of the basic elements of the PRO of the USA.

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I - Radar center of the system of ultra long-range (sverkhdalneye) detection;

1. Acquisition (obnaruzheniye) radar set AN/FPS-50;
2. Tracking (soprovozhdeniye) radar set AN/FPS-49

II-Target designation (tseleukazaniye) radar set

III-Means of the "Nike-Zeus" system:

3. Recognition (raspoznavaniye) radar set;
4. Target tracking (slezheniye za tselyu) radar set;
5. Antimissile missile tracking (slezheniye za protivoraketoy) radar set;
6. Complex of electronic-computing equipment;
7. Launching site of the antimissile missiles.

IV - Area defense center with an electronic-computing equipment complex.

In preparing a new world war, along with the development of new weapons of attack, American imperialism has in recent years been increasing work on the creation of means of antimissile defense. In this field efforts are exerted in two directions: the creation of an early warning system capable of ensuring ultra long-range detection of intercontinental ballistic missiles in flight and the creation of a complex of active PRO means capable of destroying a missile warhead.

Scientific-research work on the creation of active PRO means began in 1952 in the USA. As a result, plans for several systems were worked out; however, with the exception of the "Nike-Zeus" system, work on all the remaining plans was stopped. The basis of this system is composed of a battery of antimissile missiles, the unit of equipment for which includes: a target recognition radar set, a target tracking radar set, an antimissile missile tracking

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radar set, an intercept computing device, control equipment, launching mounts, and auxiliary equipment.

It is intended that control of the fire of several batteries be carried out from a so-called area defense center that is equipped with a target designation radar set and a computing device, the function of which is the processing of data on detected targets, and target designation for the batteries.

The organizational structure of the subunits of the system is still in the study stage, it is intended to have several antimissile missile tracking radar sets in a battery, which will permit the carrying out of several simultaneous guidance operations against one target.

The sequence of the work of the basic elements of the "Nike-Zeus" system in destroying the nose cones of ballistic missiles is as follows:

According to the early warning system's data, the target designation radar set detects the nose cone of the ballistic missile and the computing device of the area defense center, on the basis of these data, carries out target distribution and target designation for the antimissile missile batteries. The set works in a pulsed mode. Because of its great power (up to 50 megawatts per impulse) it has separate transmitting and receiving antennas placed up to 300 meters apart. In order to ensure protection of the personnel from radiation, the transmitting antenna is enclosed by a screened metal shield with a height of 20 meters. The maximum range of operation of the set is 1600 km. The time available for reliable detection of the target and for determining its parameters is about 20 seconds.

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The antenna of the recognition radar set, located in the fire complex, is aimed according to the target designation data.

The need to use such a set is brought about by the peculiarities of protecting the system from passive interference and dummy targets outside the dense layers of the atmosphere, where they have the same high speed as the nose cone of the missile.

At the present time the set is in the stage of development (dorabotka), in the process of which it is planned to use the results of the work on the "Defender" program, specifically the study of the electromagnetic characteristics of the nose cones of ballistic missiles. It is planned that the recognition set will work in the decimetric wave band and have an operating range of about 1,000 km.

After separating the real target from the group of dummy ones it switches over to the target tracking radar set, which is designated for automatic tracking of the missile nose cone and processing of the data necessary to determine the calculated point of impact and the commands for guiding the antimissile missile to the target.

Using a parabolic reflector with a diameter of 7 meters, the antenna system of the set creates a narrow pencil-like beam, which is necessary for a high degree of accuracy in determining continuous coordinates of the target. The operating range of the acquisition and tracking (soprovozhdeniye tseli) radar set is about 1,000 km.

The antimissile missile tracking radar set is designated for the automatic tracking of the antimissile missile, for processing the data necessary for guiding it to the target and for transmitting guidance commands and commands for

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detonating the warhead of the antimissile missile. In order to simplify tracking of the antimissile missile, a radar responder is installed on board.

For intercepting and destroying the nose cone of a ballistic missile, the "Nike-Zeus" antimissile missile is used; it is a three-stage wingless missile 14.7 meters long and has a launching weight of 10,400 kg. The booster of the antimissile missile, which operates on solid fuel, develops a thrust of about 200 tons. The antimissile missile has a maximum altitude of 150 km, a range of 320 km and a maximum speed of up to 2,600 m/sec. These performance characteristics are obtained both by the booster and by the powerful solid fuel sustainer motor. All the missile-borne control equipment is located in the casing of the third stage of the missile. Control of the flight of the antimissile missile in the atmosphere is carried out by means of external rudders (aerodinamicheskiy rul), and at great heights it is carried out by means of jet nozzles.

The warhead of the antimissile missile may be equipped with both ready-made (gotovyy) destructive elements and with a nuclear charge.

Destruction by ready-made elements occurs as a result of a mechanical effect on the nose cone of the ballistic missile. The nature of the destructive action of a warhead with a nuclear charge depends on the altitude at which it is employed. At heights of up to 40 km the basic destructive factor is the energy of the shock-wave; at greater altitudes it is the energy of various types of radiation, mainly neutron and roentgen.

According to data from the foreign press, total expenditures of the USA on the development of the "Nike-Zeus" system have exceeded 1 billion dollars;

however the question of developing the production of the system has been postponed until the end of its testing program. American specialists consider that the tremendous success of the Soviet Union in the field of missile technology permits it to have any missiles required with appropriate devices and to outstrip the employment of countermeasures in a PRO system. Therefore a correct understanding of the potentialities of the PRO system may be grasped only after carrying out test firings against ballistic missiles that create dummy targets and other interference.

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In order to repel a massed missile attack, a system of antimissile defense that is organized in advance and built according to a single plan on the scale of the entire country is necessary. The theoretical bases for constructing an antimissile defense are the foundation on which a PRO which gives the maximum effect with the minimal expenditure of forces and means must be built.

In constructing a system of antimissile defense, the nature of employment and the technical characteristics of the enemy's ballistic missiles, the combat capabilities of antimissile weapons, the quantity and nature of the objectives to be defended, and also their location in relation to the probable axes of missile approach exert the determining influence.

If we take the Soviet Union, then the probable axes of missile approach for it at the present time are the northern, from the USA, and the western, from Britain and Italy.

In conformity with the individual objectives of the country, specific sectors can be allotted on the probable axes of missile approach, within the limits of which the appearance of ballistic missiles of the probable enemy may be expected. These sectors are the determining factors in creating antimissile defense of objectives or groups of objectives. However, when determining probable axes and sectors of missile approach, the possibility of an attack with ballistic missiles of various classes, launched both from missile bases and from submarines and missile delivery aircraft, should be taken into consideration. 50X1-HUM

The structure of antimissile defense must provide for the interception of missiles not lower than the specific altitude at which the burst of the nuclear charge will be safe. Calculations show that for the safety of objectives of the country, when intercepting intercontinental missiles and intermediate-range missiles, the altitude of the destruction of their nose cones must be not less than 40 to 50km, and when considering the use of nuclear charges with a TNT equivalent of 7 to 10 megatons - not less than 80km. For short-range missiles. whose TNT equivalent does not exceed 1 megaton, the altitude of interception should be not less than 15km. Consequently the fire complexes must ensure destruction of the warheads of ballistic missiles at altitudes not lower than those indicated.

The defensive zones of the fire complexes exert a decisive influence on the structure of antimissile defense.

We consider the defensive zone of a PRO fire complex to be that part of the territory that is covered by the given complex. It represents the geometrical location of the possible points of impact of ballistic missile nose cones, the trajectories of which pass through the destructive zone of this fire complex.

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The size of the defensive zone of the fire complex essentially depends on the angles of fall of the ballistic missiles, and its orientation depends on the direction of firing (diagram 2).

There is a definite part of the territory that is covered by the fire complex irrespective of what are the angles of fall and from which directions the ballistic missile firing is being conducted. This part of the territory may be called the internal defensive zone.

The objectives located in this zone will be covered under any angle of fall and direction of fire; the remaining objectives located within the limits of the external defensive zone of the fire complex will also be covered, but only for certain angles of fall and directions of fire.

Obviously, by means of appropriate deployment of the fire complexes, the screening of an area that is considerable in size may be carried out. In this, the grouping of the complexes must be such that the important objectives of the area are definitely located with the limits of the internal zone.

The grouping of the PVO means must be sufficiently effective to repel massed missile strikes delivered simultaneously against a series of objectives. For this the number of fire complexes defending objectives or groups of objectives must be no less than the number of targets expected to be operating simultaneously against the given objective or groups of objectives.

In creating fire groupings, covering of the defensive zones of the fire complexes of contiguous groupings should be provided for, in order to create an overall defensive zone for all objectives located in the given area.

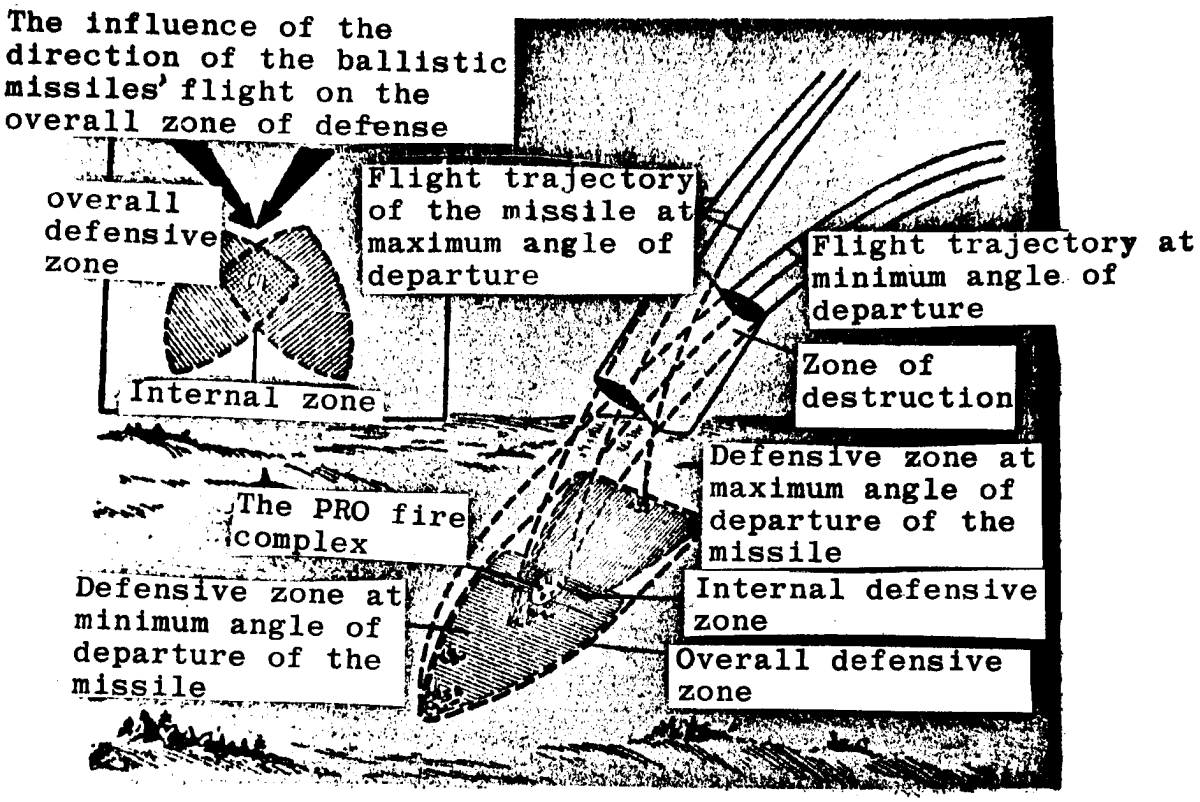

Diagram 2. Defensive zone of the PRO fire complex.

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The advisability of this formation is determined by the fact that, first, it permits concentration of the efforts of a series of groupings in repelling a strike by missiles whose number may exceed the fire capabilities of a grouping taken by itself; secondly, with a relatively smaller number of weapons it is possible to cover a larger number of objectives of various categories.

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A system of antimissile defense, it appears, should be based on the use of antimissile weapons of several types, the basic ones of which may be:

- weapons intended for screening individual areas from intercontinental ballistic missiles and intermediate-range missiles; possibly these same weapons may also be enlisted for destroying artificial earth satellites in low orbit;

- weapons intended for screening individual objectives from short-range ballistic missiles, mainly for the defense of frontier and maritime objectives.

Concerning the interception of artificial earth satellites in high orbit, for this it is apparently necessary to have other fire weapons having a great range of operation. However, the radar support of the antispace defense fire weapons can be retained by the antimissile defense.

The need to employ two types of antimissile weapons is stipulated by the fact that the weapons intended for combat with intercontinental and intermediate-range missiles cannot be employed to destroy short-range missiles.

The small ranges and flight time of operational-tactical missiles make their destruction possible at comparatively low altitudes and short distances

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from the objectives being covered. The dimensions of the defensive zones of the fire weapons intended for the destruction of these weapons will be limited to several dozen kilometers. 50X1-HUM

As a result of this, groupings of these weapons may be used to cover individual objectives and compact groupings of objectives, mainly those located in border areas. It is completely possible that it will be feasible also to combat cruise missiles with complexes of this type.

The stability of an antimissile defense system will be determined, to a significant degree, by the stability of its radar system, for the disorganization of which the enemy will use both radio interference and strikes against its most important and vulnerable elements. In connection with this, a grouping of the PRO radiotechnical equipment must be created so as to ensure that the zones of radar detection are covered by the necessary number of sets. These elements of the system, like the centers of ultra-long-range detection, must without fail be screened by antiaircraft missile complexes.

The structure of the antimissile defense must be thoroughly coordinated with the grouping of the antiaircraft (protivosamoletnyy) defense weapons. In this case the stability of the antiair defense system as a whole is increased, and the enemy is deprived of the advantages that the joint employment of aviation and missiles could have given him.

Obviously, the deployment of the antimissile defense must be carried out in a definite sequence calculated so that it ensures covering, first of all, the most important areas and objectives, and at the same time so that conditions are created for the subsequent development of an antimissile defense, which includes new elements without reconstructing the system created earlier.

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It is known that the Americans plan to carry out the construction of their PRO system in two stages.

In the first stage such elements of the system are created as radar centers for ultra long-range detection and tracking of ballistic missiles, and fire weapons capable of covering comparatively small but the most important areas are deployed. Therefore, at this stage the system of fire cover may be considered to be a point system , receiving the necessary information about the targets from the territorial detection system.

In the second stage the number of fire weapons increases; their capabilities increase, mainly with an increase in the antimissile missiles' operating range. With this, the transition from covering individual objectives and fairly small areas to the defense of a considerable portion of the country's territory is carried out.

In stating our opinions concerning PRO, we proceed from the fact that an antimissile system is not autonomous, because the antimissile and antiaircraft defense are united into a single system of antiair defense of the country. It is also apparent that control of antiaircraft and antimissile defense at the operational level should also be unified. The question of tactical PRO elements requires study.

Control of antimissile defense must, in our opinion, be organized so that coordination of the operations of its individual elements and groupings and the most effective utilization of the antimissile weapons are ensured. Its material base must be a network of mutually connected command points making widescale use of automation for studying and evaluating the situation, making decisions, and for directing the combat operations of the forces and weapons. Before the start of an enemy missile attack, it appears that control of the PRO weapons must consist, primarily,

of maintaining them at the necessary degree of combat readiness, of organizing coordination among the groupings of the fire complexes and among the radar centers of ultra long-range detection, and of comprehensive materiel-technical support.

In the process of repelling enemy ballistic missile attacks the control of the PRO weapons must consist of allotting targets among the radar centers and fire complexes, target designation, controlling the operating conditions of the radar sets, ensuring coordination between contiguous groupings of fire complexes, regulating the expenditure of antimissile missiles, and of other things.

The time available for performing the tasks enumerated is extremely limited. In conformity with the PRO system being developed in the USA, it will consist of not more than 10 to 15 minutes from the moment the missile is detected until the moment that it strikes. The "Nike-Zeus" fire complex requires only 4 minutes.

The limited time and the need to take into consideration a large number of factors, when working out a decision, require a high degree of automation of the control processes by using a whole complex of electronic computers at the command posts of all levels. In this, as shown by calculations, the operating speed of the EVM (elektronno-vychislitel-naya mashina-electronic computer) must consist of several hundred thousand operations per second.

The high level of automation of PRO, however, will not, it appears, rule out the participation of combat crews at the command posts during the process of controlling antimissile weapons. Their functions will be to react to unexpected changes in the situation, to introduce additional information, to analyze the developing situation, to clarify the initial data used in the algorithms of the machine resolution of

tasks, etc. The equipping of command posts must ensure, practically, immediate reflection of the developing situation and of the status of the antimissile defense weapons.

The control of the antimissile weapons must provide for the cooperation of antimissile defense with the antiaircraft defense. Its goal is to operate against the enemy in the most effective manner with coordinated efforts. The cooperation must provide for:

-- concentrating the efforts of the antimissile and antiaircraft weapons for the defense of important areas and objectives;

-- questions of screening the weapons of antimissile defense;

-- coordinated use of radar reconnaissance means for discovering the start and the makeup of an air-missile attack, etc.

Thus, the main features of antimissile defense control will be: a high degree of centralization and subordination to a single command, comprehensive automation at all levels and echelons of command with the widescale employment of fast-operating EVM, and coordination of the operations of antimissile and antiaircraft weapons in the overall system of antiair defense.

Antimissile defense requires a reliable and fast system for transmitting information. Therefore, when organizing PRO, questions of communications, both from the standpoint of necessary technical means and from the standpoint of its organization, acquire an especially important meaning.

The exchange of information among the individual elements of the antimissile defense can be ensured only on the basis of the comprehensive employment

of various means of communication, even the use of special earth satellites. In the PRO system of the USA, for example, it is planned to use as communication links, cable lines, microwave band radio-relay links, and tropospheric communication radio lines, in which, the transmission of information to certain levels must be duplicated on different frequencies.

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In connection with the creation of an antimissile defense, a series of particular problems arises. Let us examine some of them.

In antimissile defense, timeliness in the detection of enemy missiles being launched acquires tremendous importance. In the example of the PRO of the USA, it is seen that such a system of early warning may be constructed on the basis of employing radar sets of ultra long-range detection, moved out to the probable axes of missile approach. However, this solution does not exhaust the problems. A more complete resolution of it is connected with the creation and employment of qualitatively new means - radar sets based on the principle of back-scatter probing (vozvratno-naklonnoye zondirovaniye) of the ionosphere, or artificial earth satellites with equipment that permits fixing the moment of launch of a ballistic missile.

Calculation shows that when such warning means are set up, intercontinental ballistic missiles may be detected about 30 minutes before they strike and intermediate-range missiles 10 to 15 minutes before they strike.

Plans for organizing early warning based on the use of artificial earth satellites are being worked out.

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For example, one of them envisages a system made up of 72 satellites orbiting in six polar orbits whose planes are successively displaced in relation to one another by 60°. Twelve satellites orbiting in each orbit are the "simple cell" of the reconnaissance system that permits the simultaneous surveying of a strip of the earth's surface a little more than 6,000 km wide.

In each satellite, weighing up to 6 tons, it is intended to have an acquisition radar set operating on an impulse mode, with a range of up to 1,600 km and a scanning sector of 35°.

In view of the great operating ranges of the radar equipment and the extremely high requirements for accuracy of the radar information, important significance is acquired by the problem of studying the influence of the ionosphere on the errors of radar measurement of coordinates of high-flying objects and of working out methods to compensate for them.

It is known that when passing through the ionosphere a distortion of the path of radiowave propagation occurs and the speed of their movement changes. The first circumstance is the reason why errors occur in measuring angular coordinates, the second is the reason for errors in measuring distances. Moreover, the size of the error depends on the condition of the ionosphere.

Under the influence of factors originating in the cosmos, first of all radiation from the sun, the condition of the ionosphere constantly changes. These phenomena are both regular and accidental in nature. This leads to corresponding changes of the errors in radar measurements. Besides, within the ionosphere itself, there are dissimilarities of various scales, nature, the regularity of their appearance, the existence of which has not yet been studied

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to the necessary degree.

The accidental nature of ionospheric phenomena makes it impossible to take them into consideration and to compensate for errors in radar measurements without knowing the laws that are inherent to ionospheric phenomena and without taking into consideration the current condition of the ionosphere and the forecast.

Especially important significance is attained by this question in view of the fact that nuclear bursts can bring about artificial ionization of the upper layers of the atmosphere and changes in the condition of the ionosphere enveloping the entire globe.

The problem of excluding mutual radio interference also takes on great significance. The powerful radiation of the radiotechnical equipment of the antimissile defense, if appropriate measures are not taken, will create powerful radio interference for the other radiotechnical equipment. On the other hand, the highly sensitive receiving equipment of the antimissile weapons may find itself subjected to a powerful influence from various radio transmitting and television devices.

In view of the use in antimissile defense of radar sets with a great pulse power the problem of biological protection of personnel has arisen.

The powerful radio frequency, and in some cases even roentgen radiation, that exist when operating radio equipment, are of danger to the health of personnel. Therefore the question of reliable biological protection requires most thorough study and elaboration of both technical means and organizational measures to ensure personnel safety.

It is apparent that the search for rational resolution of these questions must be along the line of employing a system of shield protection, and

also a systematic measurement of the level of radiation in working areas, with automatic signaling when levels of radiation arise that are harmful to health.

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The powerful economy of our country and the great achievements of Soviet science are the materiel base that ensures continuous growth of the strength of the antiair defense of the Soviet Union. At the present time the antiair defense troops of the country are carrying out a new qualitative leap in their development.

Speaking at the XXII Congress of the CPSU, Minister of Defense Marshal of the Soviet Union Comrade R. Ya. Malinovskiy said: "I particularly have to report that the problem of destroying missiles in flight has been successfully resolved." This means that antimissile defense, for the antiair defense troops of the country, has already become a task of practical application.