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MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (USSR): The Postwar Development of Weapons and Equipment

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article is a summary by the late Chief of the Soviet General Staff of Soviet weapons and military equipment developed since World War II. The hardware cited is almost entirely for the Ground Forces, but some fighter aircraft and major transport aircraft are also described. Major characteristics are given for most items of equipment, including known Soviet antitank rockets and missiles, the SA-4 and SA-6 air defense missiles, and surface-to-surface free rockets and ballistic missiles. This article appeared in Issue No. 1 (86) for 1969.

2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies.

William E. Nelson
Deputy Director for Operations

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SUBJECT

MILITARY THOUGHT (USSR): The Development of the Means of Armed Combat in the Postwar Period

SOURCE Documentary

Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 1 (86) for 1969 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The author of this article is Marshal of the Soviet Union M. Zakharov. This article is a summary by the late Chief of the Soviet General Staff of Soviet weapons and military equipment developed since World War II. The hardware cited is almost entirely for the Ground Forces, but some fighter aircraft and major transport aircraft are also described. Major characteristics are given for most items of equipment, including known Soviet antitank rockets and missiles, the SA-4 and SA-6 air defense missiles, and surface-to-surface free rockets and ballistic missiles.

[redacted]

End of Summary

[redacted] Comment:

This article was written by the late Chief of the General Staff, Marshal of the Soviet Union M. Zakharov. Military Thought has been published by the USSR Ministry of Defense in three versions in the past -- TOP SECRET, SECRET, and RESTRICTED. There is no information as to whether or not the TOP SECRET version continues to be published. The SECRET version is published three times annually and is distributed down to the level of division commander.

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The Development of the Means of Armed Combat in the Postwar Period

by

Marshal of the Soviet Union M. Zakharov

Developing the fundamental propositions of Marxism concerning the objective foundation of the military power of states, V. I. Lenin repeatedly pointed out that the deepest roots of this power lay first of all in economics, that a strong and well-organized economic structure was needed in order to wage war successfully. These propositions have acquired particular timeliness in the modern era.

The military-economic might of a state is determined at the present time not only by the absolute volume of production--by the overall production levels of steel and electrical energy, by the output of coal and petroleum, by the establishment of reserves of diverse material means--but also by the availability of fissionable materials and reactors needed to produce nuclear warfare means. Today it is not enough merely to surpass the enemy in the field of industrial production. To gain superiority in the fields of science and technology has acquired the greatest importance, as these fields exert ever-increasing determining influence on the condition and development of the means of armed combat.

Thanks to the superiority of the socialist order and the rise in the creative activity of the masses, the economic might of our country grows uninterruptedly. The decisions of the Twentieth Congress of the Communist Party of the Soviet Union were particularly important in strengthening the defensive power of the Soviet Union. Our Motherland has entered into the period of the comprehensive building of Communism. The struggle to create its material-technical foundations and to raise further the economic and defensive power of the USSR have acquired scope of unprecedented extent.

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To strengthen the might of our Armed Forces, paramount emphasis has been placed on the development of the atomic and rocket industries.

Nuclear weapons were initially introduced into service in the form of atomic bombs and somewhat later also in the form of hydrogen bombs. Munitions of various yields and types were produced: low yield (with TNT equivalents up to 15 kilotons inclusive), medium yield (from 15 to 100 kilotons), high yield (from 100 to 500 kilotons), and of super-high yield (exceeding 500 kilotons).

The development of nuclear weapons has proceeded not only by way of increasing the yield, but also by decreasing the weight and simplifying the working principles of nuclear munitions, which has made it possible to equip all branches of the armed forces with them. Because of their tremendous destructive power, nuclear weapons have become the principal means of destroying the enemy when conducting various operations and waging war as a whole.

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Our probable enemies, especially the USA, are continuing to develop and accumulate chemical and bacteriological weapons. Therefore we have no right to lag behind in this field. The Armed Forces of the Soviet Union are prepared to conduct military actions both with the use of conventional means of destruction and with the use of all types of weapons of mass destruction.

In recent years the means of delivering nuclear weapons on target have been actively developed. Initially, only bomber aircraft could carry these weapons; in subsequent years, since the mid-fifties, not only have aircraft become a means of delivering nuclear weapons, but rockets of various types and functions have also become means of delivery. Rocket equipment has been intensively developed and has been incorporated into the armament of all branches and arms of troops. Rockets have become the primary means of delivering nuclear munitions on target.

Our military science has proceeded on the correct path, having rejected the existing views that aircraft should become the primary carriers of nuclear weapons. Actually, aircraft have a number of advantages over rockets as nuclear

weapon carriers. They can reconnoiter the installations against which nuclear strikes are to be delivered, locate the targets, and immediately deliver strikes against them. Their use can be particularly effective in the destruction of small and mobile targets. Nuclear weapons and new rocket weapons of the "air-to-air" and of the "air-to-surface" types, which are being incorporated into the armament of the Air Force, have considerably increased the capabilities of aircraft.

However, aircraft are required to cope with the enemy's air defense system, a system whose effectiveness increases every year. This complicates their actions to a considerable degree and limits their capabilities of delivering nuclear strikes, especially against large installations in the operational depths of the enemy area. In addition, the delivery of an aircraft bomb with a nuclear charge against a target requires an extended time interval in comparison to the flight of rockets. In this respect, the latter have an indisputable advantage.

The tremendous combat power of nuclear/missile weapons has been responsible for the establishment of a new branch of the armed forces--the Strategic Rocket Troops, whose formations and large units have been armed with intercontinental and intermediate range missiles. The decisive role in a nuclear world war, particularly in the beginning, will belong to the Strategic Rocket Troops. These are the troops that will actually fulfil the principal tasks of destroying the enemy's strategic means of nuclear attack, of smashing his armed forces, of undermining his economy, and of disorganizing his governmental and military control.

The combat means of the troops of the Air Defense of the Country have undergone qualitative changes. At present the basis of the combat power of these troops is made up of highly effective antiaircraft missile systems, missile-carrying fighter aircraft, and radiotechnical troops equipped with modern radar equipment.

Atomic submarines, new surface ships, and aircraft armed with nuclear missile weapons have been placed in service in the Navy. The Navy not only possesses tactical means of destroying enemy naval forces, but also weapons to

fulfil operational and strategic tasks. These have drastically increased its combat capabilities and changed its role and importance in modern war. The Navy is now capable of successfully carrying out combat actions in all ocean areas of the world.

Nuclear/missile weapons have been widely introduced into the large units and formations of the Ground Forces. The first models of tactical and operational-tactical rockets started coming into troop service in the nineteen-fifties. However, these were still unsophisticated and did not have nuclear charges, and thus could not exert any appreciable influence in raising the combat capabilities of the troops.

The improvement of rockets has taken the course of using nuclear charges in the warheads; of increasing their yield, accuracy, and launching range; of considerably shortening the time required to bring them to combat readiness; of increasing the movement capabilities of rocket systems, and also of decreasing the number of operating personnel.

At present the Ground Forces have at their disposal three types of rockets: tactical and operational-tactical of army and front subordination, with rocket-launching ranges of from 32 to 550 kilometers, and capable of carrying nuclear charges with yields of from 3 to 600 kilotons (Table 1). This span of rocket-launching ranges and nuclear charge yields permits front and army troops to accomplish successfully all of their principal operational-tactical tasks.

The equipping of ground troops with nuclear/missile weapons of operational-tactical and tactical designation and the increased number of tanks in the complement of large units and formations has led to the growth of their combat and fire capabilities. For example, the salvo of a World War II division as of the end of the war amounted, as is known, to 2.3 tons of TNT. At present this is now equal to 15.4 tons, and taking into consideration the nuclear munitions of the rocket battalion, it exceeds 14,015 tons (in TNT equivalent).

In an operational troop formation like a front, more striking changes have taken place. Whereas a salvo of the First Belorussian Front in the Berlin operation (at that time it was one of the most powerful formations) amounted to 2234 tons, now the salvo of the nuclear means of a modern front is reckoned at approximately 5 million tons of TNT and 696 tons of conventional means, i.e., 2200 times greater.

Thus, nuclear/missile weapons have become the primary means of striking at the enemy in a nuclear war and the principal criterion of the combat capabilities of large units and formations. For example, a modern combined-arms army can put out of action the principal forces of one of the enemy's army corps by a strike with its nuclear missiles (24 to 27 rockets with an overall yield of up to 720 kilotons). The simultaneous strike of the nuclear means of a front will permit reliably destroying up to 20 "Honest John" batteries, up to 10 divisions, and a number of other important objectives, and consequently deprive the principal troop grouping of an army group of its combat effectiveness.

It is also important to note the following. Before nuclear/missile weapons were introduced, ground troops had at their disposal fire means which permitted them to accomplish the tasks of neutralizing and destroying the enemy only to a negligible depth. The role of fire means amounted, in essence, to providing direct support of the battlefield actions of infantry and tanks. When troops were provided with nuclear/missile weapons, army and front formations obtained the capability of inflicting damage on enemy groupings throughout the entire depth of the enemy's operational formation, of quickly and reliably destroying his nuclear attack means, control posts, and rear services installations, and thereby of creating conditions favoring the achievement of the aims of the operation in short periods of time.

The development of means of mass destruction has not obviated the need to improve conventional armaments, as with their use a number of tasks will be accomplished in combat and in operations. Conventional means of destruction must permit troops to exploit with the greatest rapidity the results of nuclear strikes. In a non-nuclear war the decisive role will belong to them. Concerning rockets, when

these also have conventional charges, for example, warheads of the sub-projectile type, they can be used to strike at the enemy. The necessity of harmoniously developing various types of weapons has been corroborated by historical experience. It has been proven that the defeat of a strong enemy requires not only the destruction of his army, but also the seizure of territory, and to do this it is necessary to have weapons and combat equipment for the most varied purposes. Success in achieving the aims of an operation or combat can be adversely affected by not taking into consideration or underestimating even a single type of weapon.

In modern combat and operations, tanks, infantry combat vehicles, and armored personnel carriers will be in the lead, as they are most resistant to the casualty-producing effects of nuclear weapons. Since tanks possess great striking power, potent firepower, and high mobility, they are most adaptable for the conduct of modern combat actions. In addition, they are able to successfully traverse extensive areas of destruction and areas contaminated by radioactive and poisonous substances.

Improvements in tanks are proceeding first of all in the direction of increasing the power and effectiveness of fire by equipping them with new artillery systems and munitions, stabilizers and rangefinders, and automatic loading devices. The mobility of tanks has been raised as a consequence of increase of their range, speed, and cross-country performance; by the installation on them of equipment to cross water obstacles submerged and by swimming, and by improving their armor protection. In addition, and in order to operate in conditions of the use of nuclear weapons and other means of mass destruction, they have been equipped with nuclear, chemical, and bacteriological defense means.

Special attention is being devoted to improvements in the design of the medium tank and its weapons, the primary armored entity in the Soviet Army. In 1954 the T-54A tank, equipped with a vertical-plane stabilizer for the gun, was accepted into service. After two years, the T-54B replaced it, with stabilizers in both planes, the vertical and horizontal, and also with night-vision devices. As a

result, the probability of hitting targets while a tank is firing on the move was increased to 65 percent. In 1958 the T-55 tank, which had a number of advantages over its predecessor, came into service. Without increasing the weight, with the same specifications in weapons, armor thickness, and dimensions, it had greater highway range (up to 500 kilometers) and an increased unit of fire (from 34 up to 43 rounds), which included shaped-charge projectiles able to pierce up to 400 millimeters of armor. The vehicle was provided with equipment to cross the bottom of water obstacles, night-vision devices, and a system of special means which improved the specifications of the features protecting it against the casualty-producing features of nuclear weapons.

The medium tank was further improved by developing new models, the T-62 and T-62A. The T-62 tank was armed with the U-5TS smoothbore 115-millimeter gun, whose armor-piercing composite round has a muzzle velocity of 1615 to 1625 meters per second and a grazing range of 1870 meters. The T-62A tank is equipped with a 100-millimeter rifled gun having a projectile muzzle velocity of 1260 meters per second.

Heavy tanks have also been developed simultaneously. After the T-10 tank (1953), the T-10A (1956), the T-10B and T-10M (1957) were accepted into service. A new 122-millimeter gun with a projectile muzzle velocity of 950 meters per second and a grazing range of 1130 meters was mounted on the T-10M tank. The dual-plane stabilizer on the tank permitted increasing the probability of hitting the target while firing on the move up to 80 to 82 percent.

However, the production of new medium tanks almost equalling heavy tanks in power and armament, allowed us to stop production of the latter in 1965.

The necessity of forcing large water barriers during operations has obliged us to develop amphibious tanks. The modernization of the PT-76 tank was carried out by accepting into service the PT-76B light amphibious tank which has a gun stabilized in both planes. It has good buoyancy and can withstand waves of 4 or 5 balls, which permits them to be used in naval amphibious landing operations.

↑ primarily used for recon.

In the nineteen-fifties new models of wheeled and tracked armored personnel carriers (BTR-50P, BRDM, BTR-60P), with tactical-technical specifications superior to those of previous ones were produced and came into service. However, they were primarily means of transport for infantry, and only partially protected infantry from damage by artillery shell fragments and small-arms fire.

Under conditions of the use of nuclear weapons and the conduct of highly mobile combat actions, the infantry needed more modern vehicles having adequate armor protection, high cross-country mobility, and powerful weapons, and also resistance against the casualty-producing features of a nuclear burst. In 1965 such a vehicle was developed and placed in assembly-line production. This is a basically new type of armored vehicle which has received the nomenclature of "Infantry Combat Vehicle" (BMP-1). It has powerful weapons and high mobility, it can transport a rifle squad, and it permits fire to be delivered directly from the vehicle. In addition, it can negotiate water obstacles on the move.

In modern combat and operations a large number of tasks devolve on artillery. No matter how much nuclear weapons are improved, in combined-arms combat these cannot completely replace conventional means of destruction.

Artillery fire is needed to combat enemy artillery and mortars, tanks, radiotechnical stations, and other small targets against which it would not be expedient to deliver nuclear strikes. Furthermore, we must take into consideration that when enemy troops are hit, even with nuclear weapons, a portion of them may survive and retain combat effectiveness. Attacking troops will be able to overcome the resistance of these groups only by using artillery fire. Artillery will provide direct fire support to attacking tank and motorized rifle units, it will provide fire on the flanks and gaps and will assist in consolidating the lines seized. We must not forget that the use of nuclear weapons is restricted by the specific distances of the safety limits for our own troops.

In modern conditions, as we have already remarked, we cannot exclude the possibility that combat actions will also

be conducted without the use of nuclear weapons. It is quite obvious that in this circumstance the principal tasks of striking at the enemy will be accomplished by artillery and aircraft. Artillery fire and aircraft strikes will not only be tactically important, but also operationally important.

The development of artillery has proceeded by way of modernizing the available systems and also by producing new models of guns and rocket launchers. The maximum ranges of artillery systems have been increased, the combat and ballistic characteristics of the shells (rounds) have been improved, and their effectiveness against targets has been increased. We have accepted into service the D-30 122-millimeter divisional howitzer, which has an all-around fire capability, a maximum range of 15 kilometers, and employs HE fragmentation and shaped-charge shells; and the T-12 100-millimeter smoothbore antitank gun, which fires a projectile capable of penetrating from 300 to 350 millimeters of armor at a range of up to 2 kilometers.

Special attention has been devoted to the production and improvement of antitank guided missiles. The first model of these was the "Shmel" ATGM with a maximum wire-guided missile flight range of 2000 meters and the capability of penetrating up to 300 millimeters of vertical armor and up to 150 millimeters of armor with a slope of 60 degrees. Subsequently, troops received the "Falanga" radio-controlled antitank guided missile, with a controlled flight range of 2500 meters and an armor-piercing capability of from 250 to 500 millimeters, which could be mounted on light trucks and on combat reconnaissance-patrol vehicles (BRDM). Subsequently, to replace the "Shmel" antitank guided missile, we accepted into service a new, more versatile model of the antitank wire-guided missile, the "Malyutka", which is relatively light in weight--11 kilograms, and has a greater firing range--3000 meters.

The development of rocket artillery has proceeded by way of improving its basic characteristics: range and accuracy of fire, weight of charge, number of launching rails, and also the time required to shift from march status to combat status. Modern BM-21 rocket launchers have a maximum range of over 20 kilometers, which allows us to

strike important installations throughout the enemy's entire tactical depth and to deliver strikes at reserves moving up from rear areas. These launchers have a high rate of fire. One battalion salvo (480 rockets in 20 seconds) permits us to neutralize all enemy personnel in an area of 60 hectares, and when firing chemical warheads, to deliver a simultaneous strike throughout the entire area occupied by an enemy regiment.

We must say that as the ground forces are equipped with rockets of various types, the overall amount of artillery, and predominantly that of the Reserve of the Supreme High Command, has decreased, but up to certain limits. Thus, in operations where only conventional means of destruction are employed, artillery, as formerly, will be the principal means of fire.

Means of mass destruction have not decreased the importance of small arms, which, as is well-known, are intended to strike at the enemy in close combat. The improvement of small arms has proceeded by way of standardizing them, of decreasing their weight and, mainly, of increasing their rates of fire. The new models are considerably superior in their principal characteristics over those which were also in service in our army in the first postwar years.

The Kalashnikov automatic weapon has become the single general-purpose weapon of the infantry. Its modernization has allowed us to decrease its weight by 3.1 kilograms, while still retaining its high combat and operating characteristics. In place of the RP-46 company machinegun (weight 13 kilograms) and the SGM heavy machinegun (weight 36.9 kilograms), the troops have received the new Kalashnikov PK machinegun with front support and the PKS with mount, weighing 9 and 16.5 kilograms respectively. The RPD machinegun was replaced by the RPK light machinegun. The AKM automatic weapon and RPK light machinegun with folding stock were produced for airborne troops. At this time the troops have received the semi-automatic sniper's rifle, which fires rifle cartridges, was designed by Dragunov (SVD), and is equipped with a new sight. The PM 9-millimeter pistol has begun to be used as the personal weapon of officer personnel.

The antitank means with which the infantry is equipped, primarily the handheld and on-mount grenade launchers, are being actively improved. Their range of fire and armor-piercing ability have been considerably increased (Table 2).

The successful evaluation of models of antitank guided missiles, and also the successful development at the end of the nineteen-fifties and beginning of the nineteen-sixties of the handheld and on-mount grenade launchers of the RPG and SPG types (with improved combat characteristics), allowed us to discontinue using recoilless guns. The new on-mount grenade launchers (SPG-9) are not only significantly superior to the former SPG-82 grenade launchers in combat characteristics, but they are also more sophisticated than recoilless guns.

As we have seen, the development and improvement of various types of ground force weapons and combat equipment have proceeded by way of standardization and raising the effectiveness of fire. Providing troops with nuclear/missile weapons, increasing the number of tanks in large units and formations, improving conventional weapons, and fully motorizing the large units, have invested troops with new combat characteristics and great self-sufficiency, and have considerably increased their combat capabilities.

All of this has led to a drastic change in the nature of combat and the operational-tactical standards which existed up to now. There have emerged the capability and necessity of considerably increasing the area of an offensive (of a defense) and the depth of the tasks of large units and formations, and also of considerably increasing the speed of the offensive. Modern front formations can carry out operations throughout the entire depth of the theater of military operations in coordination with troops of other types of armed forces.

The increase in the combat capabilities of formations and large units has also been influenced by great changes in the equipment and armament of front aviation, which, as is well-known, is meant to operate jointly with the ground forces. This aviation has been armed with cruise missiles and aircraft of varied functions: fighters, fighter-bombers, bombers, reconnaissance aircraft,

military-transport and auxiliary aviation aircraft, and also helicopters.

Cruise missiles can be employed under any conditions of weather and time of day to destroy enemy installations at depths of up to 500 kilometers with nuclear strikes. We intend using them to destroy the most important objectives, such as nuclear attack means, control posts, engineer preparations, and enemy troop groupings in concentration areas.

Obsolete piston-engined aircraft have been replaced by modern jet aircraft. Aircraft of bomber and fighter-bomber aviation have become nuclear weapon carriers. In aircraft, rocket weapons of the "air-to-air" and "air-to-surface" types have made their appearance. In addition, the improvement of aircraft navigational and bombing equipment has made it possible to increase considerably the accuracy of aircraft piloting and bombing, and also the ability to combat enemy aircraft at night and in complex meteorological conditions. Equipping aircraft with electronic counter-measure means has been of great importance.

Fighter aviation has been armed in succession with the MIG-15, MIG-17, and MIG-19 aircraft. Subsequently, fighter aviation was armed with the MIG-21 supersonic fighter. The all-weather MIG-21PF fighter-interceptor, which has especially high performance characteristics, is capable of intercepting and destroying enemy supersonic aerial targets in the stratosphere on the distant approaches to the troops and installations being covered. It has a speed of 2250 kilometers per hour and a ceiling of up to 20,000 meters. Arming this fighter with guided and unguided rockets has considerably raised its combat capabilities, and the one-second salvo of its onboard weapons has been increased by a factor of five.

In coordination with antiaircraft rocket troops, front aviation fighters are capable of reliably covering troops and rear services installations from strikes by enemy aircraft and pilotless means, of carrying out the destruction of enemy aerial reconnaissance means, and of supporting the actions of other arms of aviation. In one combat sortie, a fighter aviation division can destroy in

the air up to 30 to 35 enemy tactical aviation aircraft or cruise missiles.

Fighter-bomber aviation is now equipped with the SU-7B supersonic fighter-bomber, which has a speed of 2200 kilometers per hour and a ceiling of up to 20 thousand meters. It is able to carry small nuclear bombs and conventional aircraft bombs and to effectively hit with rockets (64 missiles), and also with cannon fire, not only the enemy's aircraft and pilotless means aloft, but also his small and mobile ground targets. In addition, it can use antitank bombs which can penetrate up to 200 millimeters of armor.

The weapons and equipment of fighter-bombers permit them to reconnoiter and destroy enemy nuclear attack means and to strike the enemy's reserves, control posts, and radiotechnical means at a depth of 200 kilometers or more. A fighter-bomber division, made up of 90 to 100 aircraft, is capable of delivering more than 25 nuclear strikes in one sortie. Employing conventional and chemical munitions, it can destroy up to 10 "Sergeant" or "Honest John" battalions or 10 nuclear artillery batteries; it can neutralize up to 15 command posts or hold up for several hours the battle-field advance of one enemy division.

Front bomber aviation has been armed with YAK-28 supersonic nuclear weapon-carrying aircraft having a speed of 1830 kilometers per hour and a ceiling of up to 17 thousand meters. A bomber aviation division is capable, in one sortie composed of 75 to 90 aircraft, of employing more than 25 nuclear bombs, including large-yield bombs. It can successfully carry out the tasks of destroying enemy installations located at a depth of 300 to 400 kilometers or more.

Military-transport aviation is equipped with special turboprop AN-12 and AN-12A military transport aircraft. They have an effective ceiling of 10,000 meters, a flight range of up to 3100 kilometers (AN-12A), a cruising speed of 600 kilometers per hour, and a cargo-lift capacity of 8 to 12 tons. In one flight a military-transport aviation division of type AN-12 aircraft can drop by parachute an airborne assault made up of a reinforced parachute-assault

regiment, or else transport from 800 to 1600 tons of cargo by air. Transport aircraft are also able to transport tactical rockets.

In recent years we have produced the AN-22 military transport aircraft, which has much better specifications: range of up to 10,000 kilometers, speed of 650 kilometers per hour, and a cargo-lift capacity of 40 to 50 tons. It can transport heavy equipment or approximately 300 men.

Along with transport aircraft, there has been extensive development of helicopters, which can be widely employed to drop (land) tactical airborne assaults, to provide support to troops on the battlefield, and to transport rockets, troops, and cargo. For example, in one flight an independent regiment of MI-6 helicopters can transport up to 30 operational-tactical rockets or make an assault landing composed of one motorized rifle battalion with its weapons and up to 50 tons of additional cargo.

Considerable progress has also been achieved in the production of air defense means. We have placed in service the new ZSU-23-4 ("Shilka") antiaircraft guns, the S-75 antiaircraft missile system, and subsequently also the "Kub" and "Krug" systems specially developed for the ground forces. The latter permits hitting these enemy aerial targets: aircraft and cruise missiles flying at speeds of up to 2160 kilometers per hour at altitudes of from 3 to 20 kilometers and at a range of up to 45 kilometers. In comparison to the S-75 system, it possesses higher mobility and readiness for launching. The system requires 5 minutes to be set up in combat status. It has an 80 to 85 percent probability of hitting single aircraft with a single rocket at an altitude of up to 20 kilometers. Furthermore, specially important targets can be destroyed by antiaircraft guided missiles using nuclear charges.

With the entry of missile systems into the armament of troop antiair defenses, the role of antiaircraft artillery, particularly medium-caliber artillery, has considerably changed. Antiaircraft artillery has begun to basically carry out the tasks of directly covering field installations, primarily against strikes by low-flying aerial means

of the enemy, and has also become involved in combatting enemy airborne assaults.

We believe that as air defense troops are saturated with antiaircraft missile systems, troop requirements for antiaircraft artillery will decrease, excluding multi-barrel, self-propelled, small-caliber artillery mounts, which, as shown by experience, are an effective means of combat against low-flying enemy aerial targets. They are capable of delivering fire while on the move and have a relatively high kill probability.

The combat effectiveness of troop air defenses was significantly increased by the acceptance into service of light antiaircraft missile systems mounted on wheeled self-propelled undercarriages which are capable of hitting aerial targets at ranges of up to 4000 meters flying at altitudes of from 50 to 2000 meters and at speeds of up to 1100 kilometers per hour.

Significant advances have been made in air defense radiotechnical means. At present they permit the detection and tracking of aerial targets at various altitudes and ranges. Chief among them are the P-30 (P-35), P-12, and P-15 radar sets, and the PRV-10 heightfinder. New means of control have also come into service: the "Vozdukh-1p" and "Krab" systems, and others.

Equipping air defense troops with antiaircraft missile systems, new artillery systems, and more sophisticated radiotechnical means has drastically increased their capabilities, thereby permitting them to successfully fulfil the growing tasks of troop air defense and air defense of rear services installations.

The combat equipment of special troops (engineer, road repair and traffic control, motor transport, chemical, and communications troops) has undergone great changes.

The development of engineer armament means has been carried out in accordance with the requirements imposed on the engineer support of troop combat actions, primarily in the conditions of the use of means of mass destruction. The mobile nature of combat actions, the need to protect troops

against nuclear strikes, and comprehensive support in the high-speed crossing of areas of fires and demolitions and wide zones of radioactive contamination and flooding, have imposed on engineer troops and engineer equipment new and increased requirements whose satisfaction has primarily led to qualitative changes in engineer armament. Together with the increase in the equipping of engineer troops and arms of troops with equipment from prototypes developed earlier, new means have entered service: roadlayers, tank bridgelayers, self-propelled mechanized treadway bridges, tracked self-propelled ferries, heavy-cargo-capacity amphibious transporters, etc.

The operating speed and performance of road machines and machines to clear cross-country tracks were increased. In particular, the new BAT roadlayer permits clearing cross-country tracks in treeless terrain at a speed of up to 6 kilometers per hour, and in sparsely forested terrain up to 2 to 4 kilometers per hour. To clear the tree and urban obstacles produced after nuclear strikes, the ASM (mechanical hand) special engineer machine was developed on the T-54 tank chassis. Its telescoping boom, approximately 8.8 meters long, is able to pick up building debris weighing up to 2 tons.

The PMP pontoon-bridge train, which has improved characteristics compared to its predecessor, the TPP train, has been incorporated into the armament of engineer units. It permits laying down a bridge with a 60-ton cargo capacity and a length of more than 200 meters in 30 to 40 minutes, which is three to four times quicker than before. Also, the permissible troop movement speed on these bridges has been doubled (20 to 25 kilometers per hour). The personnel required to lay the bridges and the number of vehicles required to transport the train have been reduced. New assault river-crossing equipment, tracked amphibious transporters (K-61 and PTS), and tracked self-propelled ferries (GSP) have been introduced into service.

The necessity of providing troops with protection against nuclear weapons has been responsible for a considerable increase in the amount of earthwork. Therefore, there has been much progress in earthmoving equipment. We have produced fast-moving trenchdiggers which

move on tracks and on wheels, trenchdigging and general-purpose excavators, and for rocket troops, high performance ditchdiggers. The PZM regimental earthmoving machine with a general-purpose operating element has been developed to dig trenches and ditches in the areas where troops are in close contact with the enemy. Its output is up to 120 cubic meters of dirt an hour. A bulldozer attachment for tanks and prime movers has entered service, making possible for troops to dig for themselves and to carry out the simplest engineer work without the help of engineer troops. We contemplate constructing dugouts and shelters now from prefabricated sets of corrugated steel components and other industrial materials which can be used repeatedly.

Much emphasis has been placed on improving engineer obstacles. We have produced new types of antitank and antipersonnel mines possessing high combat effectiveness and resistance against the casualty-producing elements of nuclear explosions. To lay antitank minefields, we have designed mechanical means in the form of minelayers (towed or based on special tracked vehicles) which permit mining at a rate of 5 to 10 kilometers per hour, and also a system of mining from helicopters permitting us to carry out mining at a rate of up to 20 kilometers per hour. the MON-100 and MON-200 mines, of directional operation to hit enemy infantry with processed fragments at ranges of 100 to 200 meters, are radically new models. A new quality has been achieved in mixed minefields by producing radio and wire means for the remote control of individual land mines and charges, and also of minefields.

Means of overcoming obstacles have also been intensively developed. We have produced mine-clearing tank attachments to create passages for wheeled vehicles through mixed minefields. A particularly great amount of emphasis has been placed on developing launching mounts which permit establishing passages in enemy minefields by means of jet-propelled flexible elongated charges. In order to destroy and neutralize nuclear land mines, various shaped charges have been introduced into service, and to reconnoiter the places where the mines are placed, magnetic bomb detectors have been introduced.

The development of motor transport equipment--the most ubiquitous equipment of the ground forces--has proceeded in the direction of improving its cross-country mobility, especially on poor roads or off roads; of increasing its movement speed, cargo capacity, and range; of standardizing its units, devices, and component parts; and of simplifying its maintenance and repairs.

We have accepted into service cargo vehicles of varied designs: UAZ-450, UAZ-450B, GAZ-66, ZIL-131, URAL-375, KrAZ-257, and numerous others, and also vehicle trailers with cargo capacities of from 0.5 to 40 tons. In recent years we have developed new tracked and wheeled transporters, snow-swamp transporters, an entire series of special four-axle undercarriages and wheeled and tractor units with powered semi-trailers. Artillery prime movers have been considerably improved. Various types of them (AT-P, AT-L, At-T, GT-S) permit towing any system of field and antiaircraft artillery at speeds of 20 to 25 kilometers per hour. As a result, the troops have come to have wheeled and tracked vehicles, both multi-purpose and special purpose, and also to have modern multi-axle vehicles with increased and high cross-country mobility. The new transport equipment has raised the mobility of units and large units, and has increased the capability of the rear services to provide troops with materiel and evacuation support.

The technical equipping of chemical troops has been considerably increased. The probability that the enemy will use nuclear, chemical, and bacteriological weapons has required the production of complex protective means. In this connection, the troops have been issued means which not only provide for the disinfection, but also for the decontamination of weapons and combat equipment, and also for the personal cleansing of personnel contaminated with radioactive substances and bacteriological warfare agents. The supply system has adopted various aqueous solutions which permit both the degassing and the decontamination of the terrain.

The means of mechanizing the degassing, disinfection, and decontamination work have been developed considerably. The independent chemical defense battalion, the army and

front terrain degassing battalion, and the front's independent technical battalion and chemical defense brigade now have automatic decontamination and liquid-distributing stations, and automatic decontamination machines and shower-disinfecting units which basically permits these activities to be carried out directly in the field, in the areas where the enemy has employed means of mass destruction.

The changes taking place in the means of armed combat and the nature and methods of conducting modern operations have raised new demands for troop control means.

In the conditions when combat actions are marked by great scope, mobility, and velocity, and when frequent and drastic changes in the situation require very quick, often almost instantaneous decisions from the command and staffs, the former means cannot now ensure efficient and continuous control over troops.

The most important requirements for troop control in modern operations are extremely high efficiency, continuity, and reliability. The principal conditions for fulfilling these are to organize communications in the shortest possible periods of time and to maintain them in uninterrupted operation. Only when these are present can a commander and his staff know at any time the true situation and continuously control the combat activities of the troops subordinated to them.

In recent years the importance of radio communications as the primary means of control has increased markedly, particularly after telegraph and telephone conversations and transmissions over radio have been made secure by automatic secrecy devices. New and more powerful radio sets, which have improved characteristics in comparison to the former ones, have been put into service. However, they allow communications to be maintained at the required distances, primarily when troops are in place, but they do not as yet fully provide communications while combat actions are in progress, i.e., when command posts are on the move.

Radio-relay communications means have been developed considerably. Modern multi-channel radio-relay means have

extremely high mobility and can establish communications very speedily, which increases their dependability and ensures troops are coordinated in frontage and depth.

As a result of the widespread use of secure radiotelephone communications, sound recording means have become very important in order to record calls made. Using them made it possible to reduce the amount of documents prepared by hand, to improve information about the situation, and to raise the output of work of staff officers. Loudspeaker communications equipment has facilitated contact between responsible officers in control posts.

Together with this, various technical means of mechanizing control processes have been introduced in headquarters, in particular keyboard calculating and punchcard calculating machines, which have substantially speeded up the work pertaining to the conduct of various types of operational-tactical, engineer, rear services, and other estimates, and also the processing of reconnaissance information and data on our own troops. We have disseminated with particular wideness means of limited mechanization, which speed up the preparation of calculations associated with the employment of nuclear weapons and the assessment of the radiation situation. We have disseminated calculating reference tables, sets of calculating and radiological monitoring templates, rulers, etc. We have begun to use mobile cartographic systems and staff and topographic printing equipment to duplicate graphic and textual documents.

In very recent years mobile electronic computers have begun to come into service to carry out operational and other estimates. Until these were developed, operational staffs used these fixed computers: of the M-20 type, and the "Strela", "Ural-1", "Ural-2", "Ural-4", BESM, and "Kiev".

However, all of these reforms have not yet fully satisfied the demands made for improved efficiency in troop control. Fundamental changes in control procedures and methods can take place only after an integrated automated control system has been produced; one whose basis must be

comprised of mobile specialized computers, not only in formations, but also in large units, and also of matching high speed communications means and automatic transmitters of diverse information with automated transceiver devices. Work is already under way to develop such a system.

Research has shown that the means of armed combat have recently undergone further qualitative development. New types of weapons and varied military equipment are entering service in massive numbers.

The widespread introduction of nuclear missile weapons, and other new types of weapons in the ground forces has brought about an enormous leap upward in the combat capabilities of ground force large units and formations; it has foreordained the necessity of revising their organizational structure and previously formulated views on the nature, methods, and forms of conducting modern operations, and of revising the role and significance in these operations of various forces and means of armed combat.

Table 1

	Tactical rockets		Operational-tactical missiles		
	"Luna"	"Luna-M"	R-170	R-300	R-500
Launching range					
minimum	10-12	15	50	50	100
maximum	32-45	65	170	300	500
Type of charge	Conventional, chemical, nuclear				
Yield of nuclear charge in kilotons	3,10,20	3,10,20	10,20,40	20,40,100	300,600
Launch weight, in tons	2.3	2.45	5.4	5.9	5.4
Time to prepare rocket for launching at the launch site, in minutes	10-15	10-15	up to 35	35-40	60
Time to deploy a battalion in a launch site, in minutes	up to 30	up to 30	60-90	90-120	120-180
Time required for a second launching (with change of site), in minutes	up to 60	45-60	120	120	250-310

Table 2

Nomenclature	Caliber (mm)		Weight of Grenade Launcher (kg)	Range		Rate of fire (rds/min)	Armor-piercing ability (mm) at slope of armor		
	Tube	Projectile		With sight (meters)	Grazing (meters)		0°	30°	60°
Handheld grenade launchers									
RPG-1	30	70	2	100	75	4-6	150	---	---
RPG-2	40	80	2.75	150	100	4-6	190	150	110
RPG-7	40	85	6.3	500	330	Approx. 6	280	250	130
On-mount grenade launchers									
SPG-82	82	82	36 (with wheeled mount)	300	200	6	Approx. 200	150	Approx. 110
SPG-9	73	73	47 (with mount)	1300	800	5-6	300	200	150