ANTI-AIRCRAFT MISSILE FORCES AND ANTI-AIRCRAFT ARTILLERY

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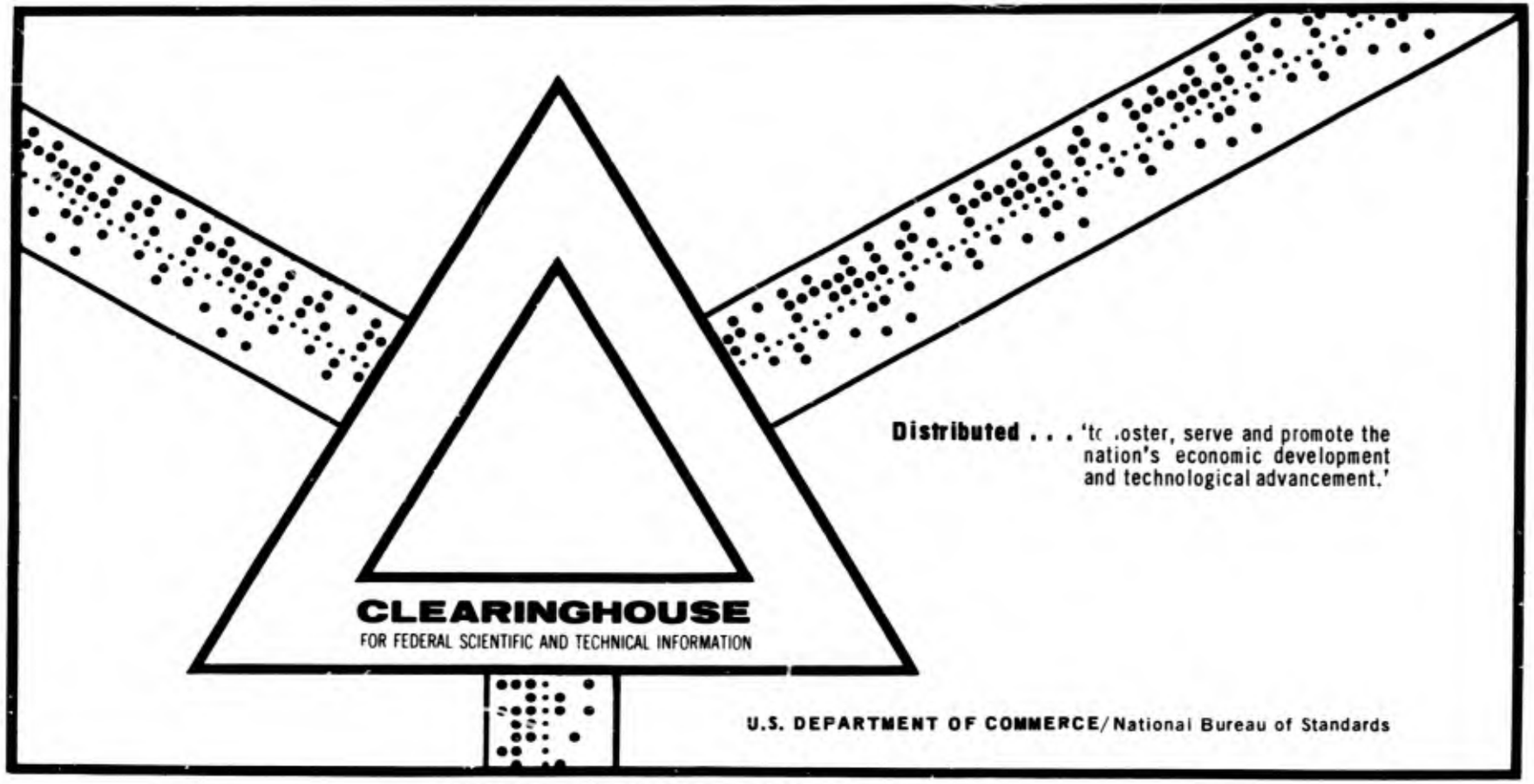

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U.S. ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER

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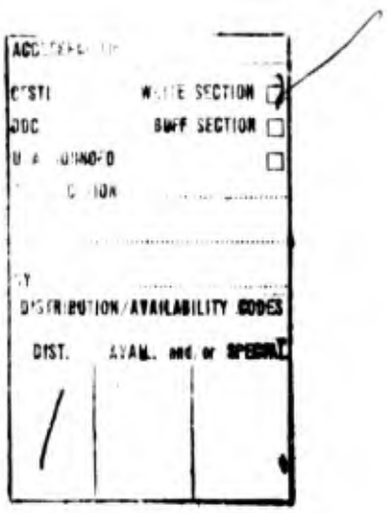
COUNTRY: USSR

TECHNICAL TRANSLATION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ANTI-AIRCRAFT MISSILE FORCES AND ANTI-AIRCRAFT ARTILLERY

By V.P. Ashkerov

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Introduction

Aviation's appearance over fields of battle and its use in order to attack troops and targets located in a country's deep rear resulted in the necessity of creating means for an anti-aircraft defense: anti-aircraft artillery, fighter aircraft, anti-aircraft machine guns, barrage balloons, and anti-aircraft searchlights. Over a period of more than 40 years there has been a continuous competition between the means of air attack and those of anti-aircraft defense, and during the course of this entire period the basic task of anti-aircraft defense has been to fight against piloted aircraft.

The appearance of nuclear weapons, of ballistic and winged missiles of various functions, of a strategic and tactical air force with great flight speeds and ranges, and of other means of air and space attack has given anti-aircraft defense the task of fighting not only against aircraft, but also against ballistic missiles and space equipment. Thus, anti-aircraft defense has obtained a greater importance. It has become not only anti-aircraft, but also anti-missile and anti-space. This has required a fundamental change in the means of anti-aircraft defense.

In a very short period of time, basically on the basis of the anti-aircraft artillery, a powerful new PVO [protivovozdushnaya oborona; anti-aircraft defense] weapon was created -- anti-aircraft guided missiles which are capable of destroying aircraft and missiles at a great distance from defended targets, at any altitude, day and night, under various meteorological conditions, and despite the use by the enemy of various kinds of impediments. The PVO air force and the radio engineering troops have undergone substantial qualitative changes.

Anti-aircraft missile weapons are presently at the disposal of our anti-aircraft missile troops which are the basic service of the country's anti-aircraft defense. They are also the chief PVO means of our land forces and navy.

At the same time, as the experience of the war in Vietnam is showing, anti-aircraft artillery continues to be a formidable weapon in the fight against modern aviation and is inflicting large losses upon the American air force.

Organizationally, the anti-aircraft artillery consists of subunits [podrazdeleniye] and units [chast' and soyedineneiye] which in a number of states are part of the land forces, the navy, and the anti-aircraft defense forces.

The anti-aircraft missile forces and the anti-aircraft artillery are designed to defend the country's political and industrial-economic centers, army groupings, naval ships, and other targets against air strikes. They accomplish their missions by destroying the means of air and space attack while they are in flight.

This pamphlet acquaints the reader with the history of the origin and development of the anti-aircraft artillery and of anti-aircraft guided missiles, with the heroic feats of our anti-aircraft soldiers during the Civil and Great Patriotic Wars, and with the equipment with which the anti-aircraft missile forces and the anti-aircraft artillery are armed.

It also gives an account of the service conditions in our anti-aircraft subunits, of the hard, responsible, but, at the same time, honorable labor of our anti-aircraft soldiers -- the constant sentries of our homeland's air space, -- and of the training of the officer cadres and other specialists of the anti-aircraft missile forces and the anti-aircraft artillery.

Brief Essay on the Birth and Development of the Anti-Aircraft Artillery and on Its Combat Applications

The extensive use during the First World War of airplanes and dirigibles (zeppelins) for the air bombardment of troops on the field of battle, of large populated points, and of other targets in a country's deep rear had an enormous influence on the character of waging war. Along with the land and the sea, air space became an arena of combat operations. Active means of anti-aircraft defense were necessary to fight against an enemy's air equipment.

Artillery became the first such means. It was a natural phenomenon to use the most powerful weapon of that time to destroy airplanes and zeppelins.

At first, ordinary field and naval cannon were used for shooting at airplanes. Thus, in Russian, 1900 and 1902 three-inch cannon which had been adapted for shooting at aerial targets were used for this purpose.

Special anti-aircraft cannon began to be designed in Russia at the Putilov Plant in the beginning of 1913 under the direction of that plant's engineer, F.F. Lender. However, the Russian army was armed with them only in March 1915. The first Russian anti-aircraft cannon had an initial velocity of 588 meters per second, a maximum altitude of 5,000 meters, and a maximum rapid-firing capacity of 25 shots a minute. Their practical rapid-firing capacity was 10-12 shots a minute.

During the First World War large or small caliber cannon were created or adapted in a number of countries for firing at aerial targets. A large amount of attention was also devoted to developing the rules and tables for firing at aerial targets. In order to provide for night operations by anti-aircraft artillery, anti-aircraft searchlights were created in 1916.

One of the major shortcomings of the anti aircraft batteries which had been adapted for firing at aerial targets was their low mobility and their low degree of effectiveness. In 1916 around 11,000 shells were

expended for each plane shot down. As a result of measures which were taken for increased effectiveness, by the end of the war an average of around 3,000 shells had to be expended to destroy one airplane.

In 1915 special fighter planes came into being, and in 1916 an air observation, notification, and communications service was created with the purpose of providing the necessary conditions for the combat operations of the anti-aircraft artillery and fighter air force. Thus, during the course of the First World War PVO equipment was created and an anti-aircraft defense system was organized in order to defend the country's troops and targets against enemy air strikes. The basis of this system was made up by the anti-aircraft artillery and the fighter air force.

After the Great October Socialist Revolution the Communist Party and Soviet government devoted a great deal of attention to the construction of the Armed Forces, including the creation of an anti-aircraft artillery. V.I. Lenin concerned himself personally with these matters. Thus, on the night of 28 October 1917 he came to the Putilov Plant, talked with the workers, and gave them the task of hastening the construction of an armored train and the assembling of cannon. As a result of two days of intense labor by the plant's workers, the armored train was completely readied and armed with 8 model 1914 anti-aircraft cannon and 14 machine guns. After being named, "The Steel Anti-Aircraft Artillery Division," the armored train took active part in battles against our enemies on the fronts of the Civil War.

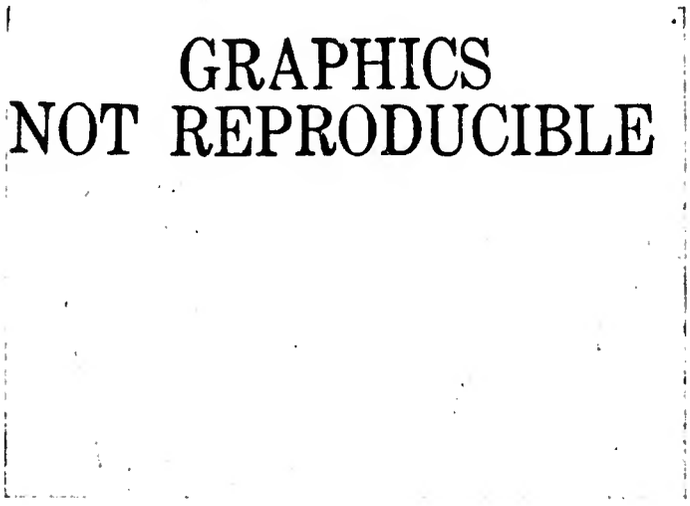
By the spring of 1918 the Red Army already contained 250 anti-aircraft artillery batteries whose personnel demonstrated an example of selfless service to its people during the years of the Civil War.

In February 1918 the Germans, violating an armistice agreement, went on the offensive along the entire front. Intensive flights were begun by the German air force against Petrograd. In order to protect the city against being bombed, a decree of the Council of People's Commissars, which was signed by V.I. Lenin, allotted substantial PVO means for its defense, including 16 anti-aircraft batteries. These measures made it possible to create a powerful defense and to repulse all of the attacks by the enemy air force.

V.I. Lenin devoted great attention to anti-aircraft artillery equipment. He was especially interested in an anti-aircraft sight which had been invented by the old Bolshevik, A.M. Ignat'yev. He gave written instructions to S.I. Aralov, the chief of the operations division of the People's Commissariat for Military Affairs, to assist Ignat'yev, and on 18 June 1920, when he paid a visit to the Main Artillery Administration with A.M. Gor'kiy, he became fully acquainted with Ignat'yev's invention. This visit is eloquently described by the great writer in his reminiscences of Lenin.

After the Civil War ended, there was a further development of the anti-aircraft artillery. In August 1924 the Red Army's first anti-aircraft artillery regiment was established, and advanced training courses were organized for the command personnel of the anti-aircraft artillery. During the years 1924-26 anti-aircraft cannon were improved. Somewhat later anti-aircraft batteries were equipped with stereoscopic range finders and graph plotting boards which made it possible to greatly increase their effectiveness.

In 1938-40 anti-aircraft artillery units were equipped with new 37-, 76.2-, and 85-millimeter anti-aircraft cannon and anti-aircraft artillery fire guidance instruments (PUAZO). These instruments employed a synchronous transmission which provided for a continuous transmission of firing data from the instrument to the cannon. Batteries which were equipped with such cannon and PUAZO were able to fire at targets which operated at altitudes of up to 9,600 meters and flew with a speed of 150 meters per second.



Thus, by the beginning of the Great Patriotic War our anti-aircraft artillery subunits had been equipped with fully modern cannon and PUAZO which made it possible to fight successfully against all the types of airplanes with which the German fascist army and the armies of its allies were equipped.

Organizationally, at the beginning of the Great Patriotic War the anti-aircraft artillery consisted of batteries, batallions, regiments, and divisions which contained the subunits and units of other branches of the anti-aircraft defense.

In organizing an anti-aircraft defense, the anti-aircraft batteries were located around the target at its nearby approaches. Their battle formation was arranged in such a way as to make it possible to repulse enemy attacks from any direction. In locating a battery, account was taken of the necessity for conducting massive fire within the belt of flight paths in which an airplane had to maintain an even movement along a direct line with the same speed and at the same altitude until it dropped its bombs. Part of the battery occupied firing positions within a target in order to defend it against attacks by dive bombers and by airplanes flying at low altitudes.

Anti-aircraft searchlights were allocated to provide for operations by anti-aircraft artillery at night. In defending large populated points like Moscow and Leningrad, illuminated searchlight fields were created to provide for the operations of fighter aircraft and the anti-aircraft artillery.

* * *

At dawn on 22 June 1941 German fascist troops treacherously attacked our country. Around 5,000 airplanes were concentrated against the Soviet Union and used during the first hours of the war to inflict massive strikes against troops, airfields, railroad junctions and stations, sea ports, cities, and other targets. The path of the fascist hordes which invaded our country was marked by the murder of peaceful citizens, rivers of blood, fires, and ruin.

From the very first minutes of the war subunits of the anti-aircraft artillery had to wage fierce battles with the enemy's air force. Repelling strikes by enemy aircraft against troops and targets that they were covering, our anti-aircraft artillery gunners inflicted serious losses upon him. The first communique of the Red Army's Supreme Command gave the following report about our troops' combat operations during the first day of the war: "At dawn on 22 June 1941 regular troops of the German Army attacked our border units along a front from the Baltic to the Black Seas.... The enemy air force attacked a number of our airfields and populated points, but everywhere encountered resolute resistance from our fighter planes and anti-aircraft artillery which inflicted heavy losses on the enemy. We shot down 65 enemy airplanes."

Concealed behind these lines of the laconic war communique were the combat operations of our anti-aircraft gunners, combat operations which were full of drama and of enormous moral and physical intensity and which resulted in repelling the furious attacks by the superior forces of the enemy's air force.

Dawn of 22 June heard the thundering volleys of our anti-aircraft batteries which were defending Brest, Kiev, Liyepayu, Vil'nyus, Kaunas, Grodno, and many other cities, railroad junctions, ports, and airfields.

Minsk, the capital of Belorussia, was being defended by units of the 7th brigade of the anti-aircraft defense. At the beginning of the war only eight two-cannon batteries were in firing position. The remaining subunits of the anti-aircraft artillery regiments were in camps. On 23 June 1941 the fascist air force undertook massive attacks against the city. Hundreds of high-explosive and incendiary bombs rained upon the city's neighborhoods, the airfield, and the Minsk railroad junction. The fascist airplanes came in continuously, echelon after echelon. They appeared over the city eleven times on that day. The fascists hoped to break the city's defenders' will to resist and to do their vile work of destroying the city and annihilating its population with impunity. The ranks of the anti-aircraft gunners grew thinner, and it seemed at times that there would not be enough of them to repel the next attack. But when the enemy's airplanes appeared again, shell after shell went flying to meet them. Together with our fighter airplanes, our anti-aircraft batteries shot down 7 enemy airplanes on the 23rd of June. On 24 June the attacks began again. Forty seven bombers took part in the first flight The fascists were inflicting their basic blow against government buildings and industrial enterprises. The forces were clearly uneven: 16 cannon were operating against 47 bombers. After the first attack, the enemy made three more massive bombing strikes during the course of the day. As a result, the fascist air force succeeded in destroying and burning a number of buildings, in disrupting telephone communications, and in inflicting heavy losses upon the city's peaceful population. The anti-aircraft gunners fought courageously against the enemy and destroyed 6 fascist bombers. On 25 June the anti-aircraft artillery which was defending Minsk was reinforced by several anti-aircraft batteries which had come out of their camps as a result of the alarm and were withdrawing from Western Belorussia. On that day the enemy lost another 5 airplanes to the fire of our anti-aircraft artillery.

On 26 June the situation around Minsk underwent a sharp deterioration, and our anti-aircraft artillery regiments received an order to withdraw to Borisov. The withdrawal took place under exceptionally difficult circumstances. The columns which were marching behind the batteries were subjected to continuous attacks from the air by airplanes which were operating at low altitudes and dive bombing. These attacks were fought off while the march was in progress by anti-aircraft artillery and anti-aircraft machine guns. However, the anti-aircraft batteries also suffered heavy losses in personnel and combat equipment. The 188th Anti-Aircraft Artillery Regiment commanded by Major P.S. Fedoruk had an especially difficult time. The regimental batteries which were making the march were unexpectedly attacked by enemy tanks. The enemy expected to shell and crush the withdrawing

columns of anti-aircraft batteries, to sow panic, and thereby achieve an easy victory. But the enemy miscalculated. Literally a few dozen seconds were needed to occupy positions on the sides of the road, to make the guns ready for battle, and to open fire.

In repelling the tank attack the gun crew commanded by Sergeant I.Ya. Zabolotskiy especially distinguished itself; it destroyed 4 tanks. This battle showed that anti-aircraft gunners had to be well instructed and trained for firing not only at airplanes, but also at tanks and other land targets.

The heroic defense of Moscow and Leningrad is one of the brightest heroic feats of our people and its Armed Forces in defending their homeland. The combat feats of our anti-aircraft artillery gunners who defended the capital of our homeland, Moscow, and the cradle of the proletarian revolution, Leningrad, are written in gold letters in the history of our state. Substantial anti-aircraft artillery forces were allotted to defend them. Thus, at the beginning of the war Leningrad's anti-aircraft artillery units were equipped with 616 85-millimeter and 60 37-millimeter anti-aircraft guns, and 230 anti-aircraft machine gun installations.

The combat operations of the anti-aircraft defense forces which were defending Leningrad began on the night of 23 June. Two groups of fascist bombers totalling 18 aircraft which were operating at a low altitude attempted to attack Leningrad from the direction of the Karelian Isthmus. Met by the fire of our anti-aircraft batteries around Gorskaya and Sestroretsk, one group turned to Kronshtadt where it encountered heavy anti-aircraft fire from the Red Banner Baltic Fleet, and, after losing 4 airplanes to the fire of our naval anti-aircraft gunners, it turned back. The second group of fascist airplanes bombed the military town and command points of the anti-aircraft artillery in the neighborhood of Pesochnaya Station. Two fascist aircraft were destroyed by our anti-aircraft batteries (the 115th and the 194th Anti-Aircraft Artillery Regiments).

The battery commanded by Lieutenant A.T. Timchenko which set fire to a fascist aircraft with its first volleys fought with especial distinction in this battle. The aircraft made a forced landing near the battery's firing position. The fascist pilot who was taken prisoner had had a large amount of experience from bombing attacks on the cities of France and Poland, and he had taken part in the bombings of London. The first attack on Leningrad ended his pirate career.

In the battles for Leningrad our anti-aircraft defense forces destroyed 1,561 enemy aircraft.

The fascist command assigned its best bomber units for the attack on Moscow, units which had had a rich experience in raids on the cities of France, England, and the other European countries of the anti-Hitler coalition. On the night of 22 July 1941 the fascists sent around 220 bombers to deliver the first blow against the capital of our homeland. The raid was made along the flight path Minsk-Orsha-Smolensk-Vyaz'ma-Moscow by four echelons flying at an altitude of 2,000-3,000 meters and separated by intervals of 30-40 minutes. At that time the capital was already being defended by 796 medium-caliber guns, 248 small-caliber guns, and 336 anti-aircraft machine guns.

At 9 P.M. on 21 July 1941 our air observation, notification, and communications posts reported a flight of fascist aircraft over Smolensk in the direction of Moscow.

When the combat alarm signal was sounded the personnel of the anti-aircraft batteries took their places at their guns and instruments. Everything was checked once again and everything was ready. A suspenseful and anxious wait for their first encounter with the enemy.

At 10:25 P.M. on 21 July a fascist air armada appeared at the distant approaches to Moscow in the operations zone of the anti-aircraft defense forces which were defending the capital, where it was attacked by our figter aviation. After breaking through the operations zone of our fighters, part of the German airplanes were illuminated by anti-aircraft searchlights; they were fired upon by the anti-aircraft batteries which were located in the illuminated searchlight fields.

At the close approaches to Moscow the fascist airplanes were met by powerful defensive fire. This fire power can be judged by the number of shots that were made. In repelling this raid, 16,000 medium-caliber and 13,000 small-caliber shells were expended. No less than 200 three-ton trucks were needed to bring this ammunition to the firing positions. Several airplanes succeeded in breaking through to Moscow and in dropping their high-explosive and incendiary bombs in disorder.

The 5th Battery of the 251st Anti-Aircraft Artillery Regiment which was commanded by Lieutenant I.V. Klets fought with especial distinction in this battle. Lit up by the searchlights, an enemy J-88 bomber proved to be a good target for the battery. Like an animal which had gotten into a steel trap, the fascist airplane struggled, attempting to break out of the beams that were blinding it. It was all in vain. The searchlight troops held it tightly in their beams, and did not let it out for an instant. At that time preparations were being made at the battery for opening fire. The illuminated target was caught by the range finders, the PUAZO crew, and the gun sighters. The altitude was determined, the encounter problem was solved on the instrument, and the settings were transmitted to the guns. A volley thundered forth; after five-second intervals there was a second and a third. The bright bursts of

the explosions flashed near the airplane, and at the same time that the sound of the explosions in the air could be heard the fascist plane crashed to the earth in flames. Somewhat later the battery shot down a second enemy bomber.

In all, in repelling the first raid on Moscow which lasted five hours, 22 airplanes were shot down, 10 of them by anti-aircraft artillery. The chief merit of the PVO soldiers was the fact that they did not permit most of the attacking aircraft to get through to Moscow and thereby saved the lives of the civilian population and saved the city itself from destruction.

On 22 July 1941 Order No. 241 of the People's Commissar for Defense contained a declaration of gratitude to the PVO soldiers, including the anti-aircraft artillery gunners, for their courage and skill in repelling the raid by the enemy air force.

That time marked the beginning of regular night raids on Moscow. Thus, on the night of 23 July the enemy made a 200-plane raid, losing 15 bombers; on the night of 24 July the enemy only succeeded in getting 2 out of 190 airplanes through to Moscow, and they were destroyed over the city by anti-aircraft artillery fire. The battle against the enemy air force demanded from our soldiers great courage, bravery, an enormous physical and moral strain, and the skilfull use of combat equipment.

The anti-aircraft artillery also made a worthy contribution to the victory at Stalingrad. At the beginning of the German offensive against Stalingrad the city was being defended by 440 medium-caliber anti-aircraft guns and 120 small-caliber anti-aircraft guns. At the end of July 1942 the command of the German fascist forces concentrated 1,430 aircraft of the 4th Air Force on the Stalingrad front, and moved its best squadrons which were equipped with the latest type aircraft there.

In August 1942 the fascist air force started massive raids on Stalingrad, Beketovka, and Krasnoarmeysk.

Especially heavy raids were made on Stalingrad on 23 August. The German air force made around 2,000 sorties on that day. Before 2 P.M. on 23 August the 1077th Anti-Aircraft Artillery Regiment, which was under the command of Lieutenant Colonel V.Ye. German and was defending the tractor plant, alone repulsed several raids by variously composed groups of fascist aircraft totalling 150 planes, and shot down 7 enemy bombers.

At 3 P.M. on 23 August the anti-aircraft gunners found themselves having to wage battles not only against aircraft, but also against enemy tanks. At that time tank columns of the fascist's 16th Tank and 3rd Motorized Divisions came out near the positions which were being occupied by the 4th and 5th Batteries of the 1077th Anti-Aircraft Artillery Regiment.

The 5th Battery commanded by Senior Lieutenant S.M. Chernyy withstood a hard battle with 80 tanks and a company of tommy-gunners. The battery suffered heavy losses, but it inflicted major losses on the enemy. As a result of the battle, the enemy lost 2 airplanes, 15 tanks, and almost a platoon of tommy-gunners to anti-aircraft artillery fire.

The battery's soldiers displayed mass heroism in repelling the enemy's attacks. Even the seriously wounded gun commanders, M.A. Chausovskiy and G.P. Kodeyev, and the sighter, Private Khalfinov, did not abandon their combat posts and continued to fight. Many died in the battle, but they held back the enemy at the cost of their lives and thereby foiled his attempt to break into the city.

Many glorious pages were written in the chronicle of the Great Patriotic War by our anti-aircraft artillery gunners in their defense of Voronezh, Sevastopol', Kursk, and many other cities, naval bases, troops on the field of battle, and other targets.

Sevastopol' -- the city of Russian glory and the largest naval base on the Black Sea -- was subjected from the first days of the war to enemy air attacks which were successfully repelled by our naval anti-aircraft gunners and fighter aviation.

In the first days of June 1942 the Hitlerites began their third great offensive against Sevastopol'. Large columns of enemy tanks and of infantry loaded on trucks and armored carriers moved against the city from the north. The 365th Anti-Aircraft Battery commanded by Senior Lieutenant I.S. P'yanzin stood on the path of this avalanche. Met by the accurate fire of our anti-aircraft guns, the enemy withdrew. After regrouping their troops, the Hitlerites again began to attack the heights where the battery was located with 2 batallions of infantry supported by 25 tanks and 18 airplanes. For 16 successive hours 40 naval anti-aircraft gunners repelled one attack after another. Only nightfall ended the battle.

The battery suffered heavy losses, but those who remained alive vowed to stand to the end. The secretary of the battery's Party organization, Bazovikov, read the vow which was signed by all of the battery's soldiers: "We swear to you, homeland, and to you, hero-people, to fall on the field of battle, but not to shame the banner of the Soviet...." At dawn of the second day the battle was renewed; the guns were put out of action, the ranks of the naval anti-aircraft gunners grew thinner, the battle was reaching the point of hand-to-hand fighting, and when only two people were left at the firing position -- the battery commander and the radio operator -- and the enemy tanks and tommy-gunners had begun to occupy it, P'yanzin radioed to call in fire upon himself from the neighboring batteries. Here is his last radiogram: "There is no one and nothing to fight with; open fire on the command post; there are a lot of Germans here." Senior Lieutenant I.S. P'yanzin died the death of the brave. He was posthunously awarded the title of Hero of the Soviet Union. A monument has been placed on his grave, on the height where the battery stood to the death.

Private P.N. Lipovenko distinguished himself in repelling one of the furious attacks of the German invaders. Leading a counter-attack by a small group of anti-aircraft gunners, he threw hand grenades at the fascists who had broken into the battery's firing positions and killed 15 Hitlerites. In hand-to-hand fighting which later developed, he personally bayoneted another 3 German soldiers. Lipovenko was also killed in that battle. The homeland showed proper appreciation for the heroic feat of its faithful son. He was posthumously awarded the title of Hero of the Soviet Union. The names of Senior Lieutenant I.S. P'yanzin and Private P.N. Lipovenko were written forever in the lists of their units.

The warriors of the heroic battery covered their names with eternal glory: Master Sergeant Shkoda, the gun commanders Strel'tsov and Danich, the seaman Nagoryanskiy, the secretary of the Party organization Bazovikov, and other seamen and officers of the battery. Their memory is alive and will live eternally in the hearts of the Soviet people.

The anti-aircraft artillery, which was a part of our combined-arms and tank units and which operated directly in the combat formations of our troops, covered these troops against enemy air strikes during all the forms of their operations: in battle, on marches, while travelling on rail and water, and while at rest -- everywhere where our troops operated the anti-aircraft artillery was their reliable shield against air strikes.

In addition to providing anti-aircraft defense for our troops and their rear and communications, the soldiers of the anti-aircraft artillery very often waged stubborn battles against enemy tanks and infantry, held defensive lines, and took part in counter-attacks and in artillery softening up operations.

For distinction in battle and for the courage and heroism of their soldiers, many anti-aircraft artillery units were awarded orders, and many of them were awarded the title of guard units and the honorary names of the cities in the battles for which these units distinguished themselves.

The 2007th Anti-Aircraft Artillery Regiment which was a part of the 4th Tank Army may be cited as an example. For distinction in battle it was awarded the title of a guard regiment and the name of Keletskiy; it was also awarded the Order of Aleksandr Nevskiy.

Along with the units of the tank army, the regiment inflicted blows against the enemy, annihilated his manpower and destroyed his equipment, and reliably covered our troops against air strikes.

In July 1944, in the neighborhood of the village of Servera on the L'vov front, the enemy threw 24 "Tiger" and "Panther" tanks into a counter-attack against our attacking subunits and forced them to withdraw. The 4th Battery under the command of Senior Lieutenant Yemel'yanenko opened up accurate fire. Four tanks burst into flames from the battery's first shots. Columns of black smoke rose from the paralyzed armored monsters. The counter-attack was broken and our troops again went on the offensive. A friendly epigram to the anti-aircraft gunner heroes of that battle was published in the army newspaper, Vpered na vraga (Foward Against the Enemy):

"Wherever the cursed enemy may be
Our shell is always in the barrel:
If we have to, we hit him in the sky,
If we have to, we hit him on land!"

On 15 February 1945 units of the 4th Tank Army under the command of Colonel General D.D. Lelyushenko had crossed the river Bober and were racing to the west. The 2007th Anti-Aircraft Artillery Regiment received the assignment to cover the troops' march near the large populated point of Reynswald which was an important road junction. Having concentrated a powerful group consisting of 6,000 infantrymen and 30 tanks supported by 50-60 "Fokke-Wulf-190" and "Me-109" aircraft and 30 "J-87" aircraft, the enemy began an offensive against Reynswald in order to occupy this populated point, cut off our troops from our main advancing forces, surround and annihilate them, and reestablish a defense along the river Bober.

At dawn on 15 February the regiment took up a combat formation near Reynswald, and at around 10 o'clock in the morning the enemy infantry supported by tanks and aircraft began an offensive. A fierce battle began. The fascist aviation in groups of 6-18 aircraft struck continuously against the regiment's positions, while at the same time the battery's firing positions shelled the attacking enemy infantry and tanks. An exceptionally difficult situation developed. The artillery commander of the 4th Tank Army, Major General of Artillery N.F. Mentyukov, and the commander of the 68th Anti-Aircraft Artillery Division, Colonel A.F. Kozlov, who had arrived at the regiment at that time, gave the regiment a combat assignment -- to hold Reynswald at any price; at the same time they gave instructions to move the 1995th Anti-Aircraft Artillery Regiment and 2 anti-tank batteries up to this area, and also gave the regiment a tank platoon. The anti-aircraft gunners defended themselves staunchly; however, the enemy's tommy-gunners succeeded in infiltrating and occupying the western outskirts of Reynswald. A detachment was formed from the regiment's guidance battery and from the guidance detachments of the batteries, and it was given the assignment of not permitting any firther advance by the enemy. All of the attempts of the enemy's tanks to come into Reynswald were repelled by the fire of the batteries. As a result of the first day of battle, the regiment's anti-aircraft gunners destroyed 5 tanks and shot down 4 airplanes, and

the enemy suffered serious manpower losses. However, there were also substantial losses of the enemy's personnel. During a raid on the regiment by fascist aircraft the division commander, Colonel A.F. Kozlov, was killed. The batteries of small-caliber anti-aircraft artillery of the 1995th Anti-Aircraft Artillery Regiment and the anti-tank batteries which came up on the following day took up defensive positions. The battles for Reynswald continued for two more days. All of the enemy's attempts to break the defense of the anti-aircraft batteries were unsuccessful.

The regiment's soldiers, sergeants, and officers displayed mass heroism. They did not spare their blood or their very lives to defend their homeland. Communists and komsomol members showed an example of this. The regimental deputy commander for political work, Major V.I. Kalinin, inspired the soldiers to combat feats in word and deed. He was always in those places where it was most difficult and dangerous. In one of the battles Major Kalinin died the death of the brave.

The regiment's intelligence chief, the 22-year-old Captain A.A. Grigorchuk, received the assignment to reconnoiter the enemy. Having arrived late at night at a populated point which was located several kilometers from Reynswald, he unexpectedly found himself in the very midst of the enemy. The entire village was literally full of vehicles, guns, armored transport carriers, and tanks around which German soldiers were crowded. The situation seemed hopeless. How was he to get out of it? The hope was that the confusion which reigned among the fascist soldiers, the darkness, and also the captured German vehicle on which Grigorchuk had arrived would help him to get out of the village without being noticed. But he could not leave without finding out the enemy's strength. Captain Grigorchuk made a bold decision -- to drive around the whole village and count the enemy's forces. And the vehicle drove slowly through the streets, carefully driving around the enemy equipment which was standing on the road. The fascists took those who were riding in it for their own people. Who would ever think that Soviet intelligence officers were in the vehicle. Thus, the resourcefulness, daring, and coolness which were shown by Grigorchuk and his comrades helped them to get important information.

Pfc. G.V. Belyakov was carrying shells in his vehicle; there was an acute shortage of them at the battery. The ammunition boxes had begun to burn from a direct hit by a shell from a fascist tank. An explosion could be expected at any minute. Belyakov began to pull out the boxes with the shells and, risking his life every second, he put out the flames and thereby saved the shells which were so necessary for the battle and saved the truck.

Taking part in repelling tank attacks which were supported by aircraft, a gun crew commanded by Sergeant A.N. Tsibin destroyed 4 tanks and 2 armored troop carriers and shot down 3 airplanes. All of the soldiers were awarded orders and medals for their combat feats.

In the battles with the enemy in the air and on land the combat training of the anti-aircraft gunners grew stronger, the tactics of conducting combat operations were perfected, and the methods of organizing and conducting fire were improved. Anti-aircraft artillery began to be used under camouflage to defend large populated points and other important targets, and also troops on the field of battle. It participated in air blockades of surrounded enemy groupings, and covered railroads and water communications. Anti-aircraft armored trains were extensively developed to defend railroad junctions, stations, and echelons. Gun sighting radar stations with which the anti-aircraft artillery began to be equipped played a large role in increasing its effectiveness. They made it possible to conduct fire at air targets at any time of the year and day and under any weather conditions. This reflected on the losses which the enemy suffered from anti-aircraft artillery fire. During the Great Patriotic War the PVO forces alone shot down 3,145 enemy aircraft with anti-aircraft artillery and anti-aircraft machine gun fire.

* * *

After the Second World War there was a further improvement of the anti-aircraft artillery both with respect to the creation of new anti-aircraft artillery complexes, and with respect to the methods of their application in battle.

At the beginning of the 1950s the anti-aircraft artillery subunits of the Soviet anti-aircraft defense forces were reequipped with new 57-, 100-, and 130-millimeter anti-aircraft artillery complexes which possessed higher technical and tactical characteristics. Thus, the 130-millimeter anti-aircraft gun has a better altitude and distance range and firing speed than the American 120-millimeter anti-aircraft gun which has an altitude range of somewhat more than 14,000 meters, a distance range of 25,000 meters, and a firing speed of 12 shots per minute.

Anti-aircraft gun commanded by Sergeant A.N. Tsibin during a break between battles.

The present-day anti-aircraft battery represents a single complex which consists of several (4,6,8) semi-automatic or automatic anti-aircraft guns, an anti-aircraft artillery fire guidance instrument (PUAZO), a stereoscopic range finder, a gun sighting radar station (SON), and units which supply electric power to all of the synchronously interconnected machinery and instruments. The radar stations with which the anti-aircraft artillery is equipped make it possible for it to conduct firing at night, with poor visibility, and under difficult meteorological conditions. In relation to the caliber of the guns, the anti-aircraft artillery is divided into small-caliber (20-60 millimeters), medium caliber (from 60 to 100 millimeters), and large caliber (more than 100 millimets) artillery.

The combat operations of an anti-aircraft artillery battery, beginning with its discovery of an aerial target and until the time it hits it with fire, are carried out in the following manner. Data on the location of an aerial target is received at the gun sighting station from the radar intelligence and target-finding station. On the basis of this data, the gun sighting radar station searches for and finds the target and automatically stays on it constantly.

While accompanying the aerial target, the gun sighting station determines its current coordinates and simultaneously transmits them to the anti-aircraft artillery fire guidance instrument which, in its turn, works out the firing data. The latter is received continuously by the gun through simultaneous transmission. The firing is effected in accordance with the readiness of the gun.

The special characteristic of anti-aircraft artillery fire consists in the fact that its fire is directed not at the point where the moving target is located at the moment of the shot, but at an established point which lies ahead of the target's path of movement. The shell has to arrive at this point at the same time as the aerial target. The solution of the encounter problem is performed continuously by the anti-aircraft fire guidance instrument. The gun settings are also worked out continuously and transmitted by simultaneous communications cables to the guns which are aimed at the established point by power drives.

In view of the brief period during which the target is in the battery fire zone, anti-aircraft artillery fire is performed without firing to find the range. Each volley, shot, or round is calculated and fired, as it were, at a new target, with new settings. In certain cases, for example, in repelling a raid by aircraft which is coming in an unbroken stream, barrage fire may be employed. Two types of shells are used by small-caliber anti-aircraft artillery: fragmentation tracer grenades and armor-piercing tracer shells. Since small-caliber anti-aircraft fire is designed for a direct hit on the target, its shell has a contact fuse. When the grenade encounters the target an instantaneous explosion takes place which produces a large quantity of fragments.

Fragmentation grenades and armor-piercing shells may be used for medium-caliber anti-aircraft artillery. The fragmentation grenade, which is designed for firing at airplanes, may be used, when necessary, for firing at tanks and other land targets. In order for the missile to explode in the necessary place, the anti-aircraft grenade has a proximity fuse. When the grenade explodes, 500-600 fragments of various weights are formed. Some of them reach a weight of 50-100 grams. However, it should be noted that the increase in the combat potentialities of the anti-aircraft artillery has increasingly lagged behind the development of the means of air and space attack, and this has required the creation of improved anti-aircraft defense weapons.

Modern Means of Air and Space Attack and the Possible Character of Their Use

After the Second World War the imperialist circles of the USA and their allies began to pursue an aggressive policy which was aimed at preparing a new world war. Special attention was directed at developing qualitatively new means of armed struggle -- nuclear weapons and their chief carriers, ballistic missiles and aircraft.

The appearance of nuclear weapons and the use of the airplane as their carrier sharply increased the striking power of the air force. One airplane carrying a nuclear bomb was able to produce much greater destruction than hundreds and even thousands of airplanes armed with ordinary bombs.

At the same time that aircraft was being developed, missiles of various classes and functions began to be developed and introduced, including intercontinental missiles which were capable of delivering a nuclear warhead to any point on the earth.

A new concept appeared: "means of air and space attack." These means began to be classified abroad to include ballistic and winged missiles with various ranges, strategic, tactical, and carrier aircraft, and also artificial earth satellites and various military-purpose space devices.

The rapid quantitative and qualitative development of ballistic missiles has resulted in the fact that they have now become the basic carriers of nuclear weapons. In accordance with their designations, ballistic missiles are divided into strategic missiles and operational tactical missiles. Strategic ballistic missiles abroad include intercontinental ballistic missiles of the "Minuteman" and "Titan" type with a range of 10,000-22,000 kilometers which are launched from above-ground or underground launching facilities. These missiles are equipped with nuclear warheads with a power of from 1 to 5 megatons. The medium-range ballistic missiles include the various modifications of the "Polaris" type missile which has a range of 2,000-4,600 kilometers. Atomic submarines which are capable of effecting a launching from underwater are armed with these missiles.

The "Pershing," "Sergeant," and other operational-tactical ballistic missiles have a range of 20 to 600 kilometers and are mounted on mobile launching platforms. Like the ballistic missiles, strategic missiles may be armed with nuclear warheads. The field armies of the USA and its allies are armed with these missiles.

A shift to hard-fuel engines is the basic direction in the further development of ballistic missiles. Such engines are simpler to operate, smaller in size and weight, more economical, and they provide for

a greater degree of efficiency.

A great deal of work is being done to create global missiles which will make it possible to strike targets from any direction.

In addition to the development of ballistic missiles, great attention is being devoted to a further improvement of piloted aircraft and pilotless means of air attack.

The modern strategic air force is equipped with B-52, "Vulcan," "Victor," B-58, and "Mirage-IV" heavy and medium bombers which have speeds that are equal to or somewhat in excess of the speed of sound, a bomb load of 10 tons and more, a flight range of around 16,000 kilometers, and a practical ceiling of 20,000 meters. The improvement of strategic bombers in the capitalist countries is following the path of arming them with winged "air-to-ground" missiles which make it possible for them to hit targets 160-800 kilometers away, without entering the operations zone of an anti-aircraft defense.

A great deal of work is being done to equip bombers with radio interference equipment and with equipment which makes it possible to fly at low altitudes.

The most numerous means of air attack is made up by the tactical air force which is designed for striking targets located in the theater of military operations, for isolating a combat operations area, and for supporting land forces. The tactical air force is armed with supersonic F-100, F-101, F-104, and F-105 fighters. The vast majority of them are nuclear weapon and "air-to-ground" carriers. The flight range of modern tactical aircraft is 2,000-3,500 kilometers, their speed is 1,000-2,000 kilometers an hour, and their maximum flying altitude is 15,000-20,000 meters. Their further development is following the direction of creating multi-purpose supersonic fighters capable of operating under difficult meteorological conditions and at low altitudes.

Aircraft carrier aviation is being assigned a substantial role as a means of air attack. It is designed for striking against sea and against coastal targets. Aircraft carrier aviation is armed with near-sonic and supersonic A-3, A-4, A-5, P-4c, and "Phantom" deck light bombers which carry bombs and "Bullpipe" missiles, as well as with multi-purpose fighters which are capable of performing the assignments of light bombers. All of the aircraft of the aircraft carrier air force can be used as nuclear weapon carriers.

Pilotless means of air attack consist of winged missiles and aircraft which are designed for reconnaissance.

The strategic bombers of England and the USA are armed with "Blue Style" and "Hound Dog" "air-to-ground" winged missiles, while the aircraft of the tactical and aircraft carrier air force are armed with

"Bullpipe" missiles.

The self-aiming "Shrike" missile with which aircraft carrier light bombers are armed is used for strikes against the radar stations of the anti-aircraft missile forces, the anti-aircraft artillery, and the radio engineering forces.

According to data from the foreign press, a great deal of attention is being devoted by the military leaders of the USA to plans for the use of outer space for military purposes.

Chief attention is being devoted to creating artificial intelligence satellites. "Semos" satellites are used for target reconnaissance. They are equipped with photographic and photo-television equipment which make it possible to photograph an area and the objects and structures located on it. "Ferret" satellites are used for the reconnaissance of radar stations and their frequency characteristics.

"Midas" satellites are used for discovering the launchings of ballistic missiles at the moment of their launching. "Transit" navigation satellites are also of great importance; they are used to direct the navigation of ships, submarines, and airplanes.

The use of the means of air and space attack occupies a very important place in the strategic plans of the military leaders of the USA and the aggressive NATO bloc. They believe that the missions of a general nuclear war have to be accomplished above all by the means of air and space attack, through a suprise and massive use of these means in the initial period of a war. Toward this end, the American and NATO military leaders have created and are maintaining in constant combat readiness powerful groupings for air and space attack which are equipped with nuclear weapons and which are located in various areas of the earth and on the seas.

In order to decrease the vulnerability of the means of air and space attack, ballistic missiles are placed in underground launching installations and on submarines, and aircraft are located at numerous airfields and military air bases.

In order to overcome anti-aircraft defense and decrease losses from the actions of the anti-aircraft missile forces, the anti-aircraft artillery, and the fighter air force, it is planned to make massive use of winged missiles which will permit aircraft crews to hit targets without entering the operational zone of the anti-aircraft defense, as well as flights at the lowest possible altitudes and the use of all types of active and passive interference.

In the opinion of foreign military specialists, flights at low altitudes are one of the basic means of overcoming an anti-aircraft defense since this substantially reduces the range at which aerial targets

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One of the ways of dropping bombs from low altitudes.

can be discovered by PVO radar equipment and the time during which they are in the zone of anti-aircraft fire, and it also ensures a sudden attack.

A great deal of importance is being attributed to the use of "Shrike" anti-radar missiles for the destruction of radar stations and, above all, missile and gun aiming stations.

The "Shrike" missile is equipped with a homing guidance head which permits it to home in on the beams of radar land stations. The "Shrike" missile is launched from an airplane at a distance of 40-50 kilometers from its target.

Strategic aviation's basic bombing method is to drop bombs from a horizontal flight; tactical aviation performs this bombing and, in addition, drops bombs on and shells targets with missiles and cannon from diving and pitching positions. Raids on targets and the departure after bombing is usually performed at low altitudes.

Due to the fact that aircraft are equipped with nuclear bombs and guided missiles, it is no longer necessary to bomb targets with large groups of airplanes. In the opinion of American military specialists, it is advisable to carry out bombing attacks with small groups and even single airplanes.

In its bombing raids on targets in the Democratic Republic of

Vietnam, the American Air Force usually operates on a broad front with small groups of 4-8 airplanes which make their raids at low altitudes. Airplanes which come from aircraft carriers make their raids at extremely low altitudes. When raids are made on important targets, use is frequently made of large groups of aircraft flying in echelons. Thus, the raid on the city of Vin' in early April 1966 was made by around 80 F-100 and F-105 airplanes operating in two echelons with an hour and a half interval between echelons.

Fighters are assigned to cover the operations of attacking aircraft with the function of suppressing anti-aircraft missile and anti-aircraft artillery batteries and radar stations, and fighting against interceptor aircraft. Bombs, "Bullpipe" missiles with a range of 11-17 kilometers, and napalm bombs are used in raids on targets. "Snake eye" bombs with umbrella-shaped steel stabilizers which slow down their fall are used in raids at low altitudes. This makes it possible for the airplane to fly off to a safe distance from the explosion. All of this requires that the personnel of the anti-aircraft missile forces and the anti-aircraft artillery make a constant study of the operational methods of the enemy's air and space forces, and also that the forms and methods of combat operations by the anti-aircraft missile forces and the anti-aircraft artillery be constantly improved.

Birth and Development of Anti-Aircraft Missile Forces

The history of the birth of missiles finds its beginning in the remote past. The first missiles, which were given the name, "fiery arrows," were created immediately after the invention of gun powder.

Mankind subsequently returned more than once to the idea of creating missiles and of their practical use for military purposes. Information has been preserved about the successful use of powder missiles by the Indians in the Anglo-Indian War of 1766, and by the English in wars against France and Denmark in the early 19th century. Powder missiles began to be used in Russia as early as the 15th century.

The theory and practice of missile construction has been worked upon by the outstanding Russian scientists A.A. Zasyadko, K.I. Konstantinov, N.I. Kibal'chik, K.E. Tsiolkovskiy, N.Ye. Zhukovskiy, I.V. Meshcherskiy, and many others.

Soviet scientists have made an enormous contribution to the development of missile science. Missiles which were created by Soviet designers during the prewar years found broad application on the fronts of the Great Patriotic War. Our celebrated "katyushas" became famous in the entire world. Missile weapons underwent an especially broad development after the Second World War. This was promoted by the enormous progress in the development of science and technology.

GRAPHICS NOT REPRODUCIBLE

In an exceptionally brief period of time Soviet scientists, engineers, and workers created missiles of various classes and functions which have found a broad application in all of the branches of the armed forces: the Strategic Missile Forces, the Anti-Aircraft Defense Forces, the Land Forces, the Air Force, and the Navy.

The development of special anti-aircraft missiles began during the Second World War. At first they were unguided missiles armed with heavy warheads. However, due to major structural defects, they did not become widespread. During the first half of the 1950s the PVO forces began to be armed with anti-aircraft guided missiles.

At first, separate anti-aircraft guided missile units were created; they later formed a new branch of the PVO -- the Anti-Aircraft Missile Forces. Anti-aircraft guided missiles have great combat potentialities. They are capable of fighting against practically all means of air attack which operate at both high and low altitudes and which fly at supersonic speeds. Their use does not depend upon the time of the year or day, or upon weather conditions; they are capable of withstanding great load factors and, thereby, of hitting aerial targets which carry out any anti-aircraft maneuver. An important combat characteristic of anti-aircraft missiles is their high degree of precision. Whereas during the Great Patriotic War the medium-caliber anti-aircraft artillery expended an average of 300-400 shells to destroy a single airplane, one or two missiles are required to hit a present-day airplane. This is witnessed by the experience with the American U-2 intelligence plane which invaded our air space on 1 May 1960. The airplane was shot down by the first missile. Battle experience in North Vietnam also testifies to the high effectiveness of anti-aircraft missiles. Thus, an American pilotless intelligence plane was shot down by the first missile over Hanoi at noon on 8 July 1966.

An anti-aircraft missile has been launched

The use of atomic warheads in anti-aircraft guided missiles sharply increases their effectiveness. According to data from the

foreign press, the blast of an anti-aircraft missile's atomic warhead destroys all aerial targets within a radius of 600-1,300 meters from the center of the explosion.

Anti-aircraft missile units are used for defending a country's important targets, areas, and territories, and also for covering naval and land forces.

They are classified among the class of "ground-to-air" ("ship-to-air") missiles.

Anti-aircraft guided missiles can be launched from both mobile and stationary launching installations, or from ships.

The anti-aircraft missile forces consist of units which are armed with combat anti-aircraft missile complexes of various functions.

In relation to their purpose, anti-aircraft missile complexes abroad are subdivided as follows: anti-aircraft missile complexes for fighting against aerial targets operating at low altitudes (up to 15,000 meters); anti-aircraft missile complexes for fighting against aerial targets at medium and high altitudes (up to 30,000 meters); and long-range anti-aircraft missile complexes (up to 300-400 kilometers and more).

Anti-aircraft guided missiles are at present the only means which are capable of hitting ballistic missiles on their flight trajectories. In the American armed forces anti-aircraft guided missiles are organized into divisions. A division usually consists of 4 batteries, and in each battery there are from 6 to 12 launching installations.

A battery is an anti-aircraft missile complex which consists of anti-aircraft guided missiles, launching installations for launching the missiles, radar stations for aiming the missiles, and also various equipment for checking, storing, and preparing the missiles for launching.

With respect to their systems, anti-aircraft guided missiles are in most cases winged missiles. An anti-aircraft missile consists of a glider, an on-board guidance apparatus, a warhead, and launching and sustainer engines. The glider's cigar-shaped body is usually made of aluminum and magnesium alloys and is broken down into sections. The nose section contains the homing system equipment. The following sections contain: the warhead, the guidance apparatus, the fuel section, and the engine installations. The wings and rudders are attached to the outer surface of the body.

The missile's warhead section contains the warhead which consists of an ordinary or nuclear explosive substance. Targets are struck by the fragments, shock wave, thermal action, and radioactive substances which are formed by the explosion of the warhead. According to data which has been published in the foreign press, the weight of an ordinary warhead

may reach a weight of 200 kilograms. The trotyl equivalent of the power of an anti-aircraft missile nuclear warhead usually ranges from 1 to 10 kilotons. The fuel section is filled with hard fuel or liquid fuel propellants which are placed in tanks. Powder and other compositions are used as hard fuel. Propellants consisting of gas fuel and an oxidant are used as liquid fuel.

Anti-aircraft guided missiles are usually two-stage missiles and have launching and sustainer engines. The launching engines (launching boosters) are designed for launching and accelerating the missile in the initial section of its trajectory. The sustainer engines are for ensuring a definite speed and flight range. After their fuel is burnt up the launching engines are automatically jettisoned as a useless load, and this makes the missile much lighter.

At the moment that the operation of the launcher engine ends and it is jettisoned, the sustainer engine is switched on and it begins to operate. Depending upon their purpose, anti-aircraft guided missiles may use liquid-fuel missile engines which operate on liquid fuel, missile engines which operate on hard fuel, and ramjet engines. Liquid-fuel missile engines have the most complex systems. They usually consist of a head, stream or swirl injectors (and sometimes a combination of both), a combustion chamber (cylindrical or spherical in form) which becomes a nozzle designed to increase the speed of the flow of discharge gases, cooling jackets, a fuel ignition device, and a feed and control system.

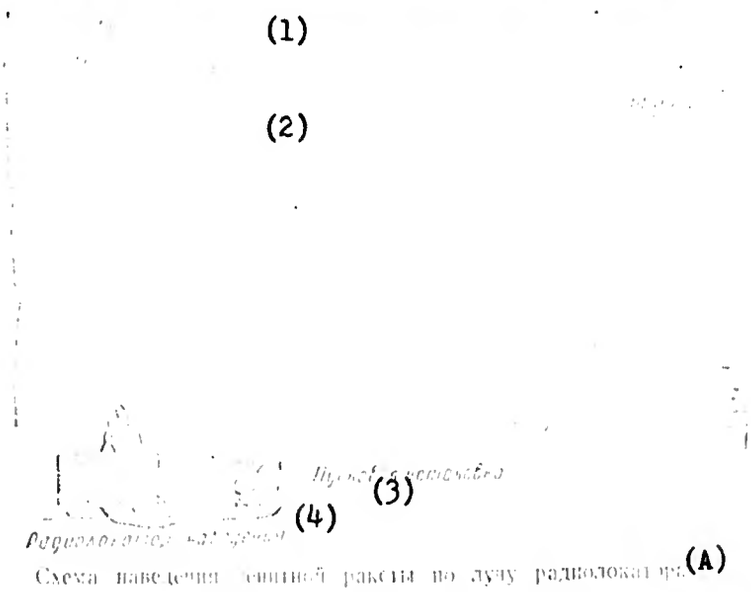
Missile engines which operate on hard fuel consist of a combustion chamber, a nozzle, a fuel grain, and a fuel ignition device. The fuel grain consists of a solid compound of a fuel and an oxidant. In cases when it is necessary to obtain a powerful impulse thrust, a multi-grain charge is put in the combustion chamber. While the engine is in operation great pressures (200-300 atmospheres), high temperatures (as much as 3,000 degrees), and gas exhaust speeds exceeding 2,500 meters per second develop in the combustion chamber and the nozzle. Operations under these circumstances result in the rapid destruction of the engine. In order to ensure the engine's operation, the combustion chamber and the nozzle are made of special heat-resistant grades of steel. A ramjet engine consists of an intake diffuser, a combustion chamber, and a jet nozzle. The air stream which is compressed in the diffuser goes into the combustion chamber into which the fuel is injected. The heat which is produced during combustion warms the air which increases in volume, and the gas flow rushes to the discharge through the nozzle. As the temperature rises, the gas continually expands and its discharge speed increases.

The thrust power results from the pressure of the gas flow on the engine's walls. Just as in missile engines which operate on hard fuel, the combustion chamber and the nozzle are made of heat-resistant steel.

GRAPHICS NOT REPRODUCIBLE

During its flight a missile is influenced by various forces (wind, a change in the density and temperature of the air at various altitudes, shifts in the missile's center of gravity as a result of the fuel combustion, etc.); therefore, an automatic pilot which controls the missile's flight by means of small gyroscopes is used in an anti-aircraft guided missile for the automatic computation and elimination of deviations from the assigned direction. Usually, an anti-aircraft missile is equipped with an automatic pilot with three gyroscopes which control the missile's altitude, direction, and heeling by means of aerial rudders, and, in certain cases, gas-dynamics systems.

The effectiveness of anti-aircraft guided missiles depends above all on their control systems. A control system implies the aggregate of devices which effect the control of the missile during the entire trajectory of its flight until it meets its target. There are at present several anti-aircraft missile control systems. Three systems have become the most widespread: telecontrol, homing control, and these systems combined. In the telecontrol system the anti-aircraft missiles are guided by a radar beam or by a command control system. When missiles are guided by a radar beam, after it is launched the missile is placed by an assigned program in the radar guidance station's beam and is held by radio equipment in the missile on the line, radar-missile-target, during its entire flight path until it strikes the target. The virtue of this guidance system is its relative simplicity, and, most important, the possibility of using a single beam to guide a series of missiles which are launched one after another after definite intervals.



Key: A. Diagram of anti-aircraft missile guidance by radar beam; 1. Striking the target; 2. Three different moments of the location of the target and the missile; 3. Launcher; 4. Guidance radar.

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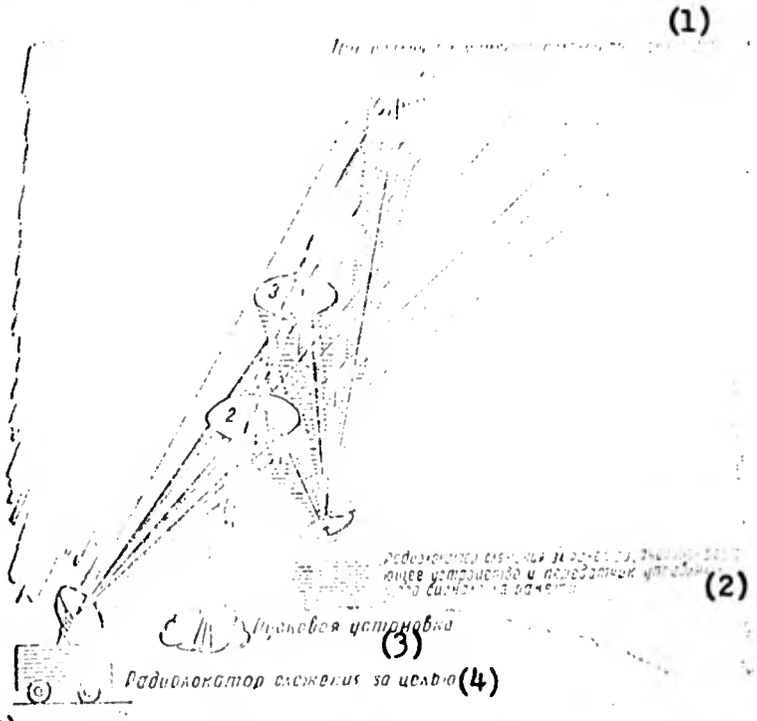
In the command control system, the guidance of the anti-aircraft missiles is effected by means of two land-based radar units. In this case, one radar unit follows the target, and the other the missile. Both radar units continually determine the current coordinates of the target and the anti-aircraft missile. Data on the position of the target and the missile are transmitted to a computer where it is converted into control commands which are transmitted by radio from the command point (control point) which is located on land or on a ship to the missile. In this way, the missile is guided to the target. The virtue of the command control system is its great precision, the relative simplicity of the on-board equipment, and the possibility of using various guidance methods (direct guidance, or the "three point" method: guidance with a constant lead factor, the method of parallel convergence, and the method of half linearization). A shortcoming of the command control system is the fact that as the distance increases the precision of determining the target's and missile's coordinates decreases, and, consequently, the precision of the guidance decreases. In order to eliminate this shortcoming, a homing guidance system is used in the final section of the missile's flight trajectory as it approaches its target.



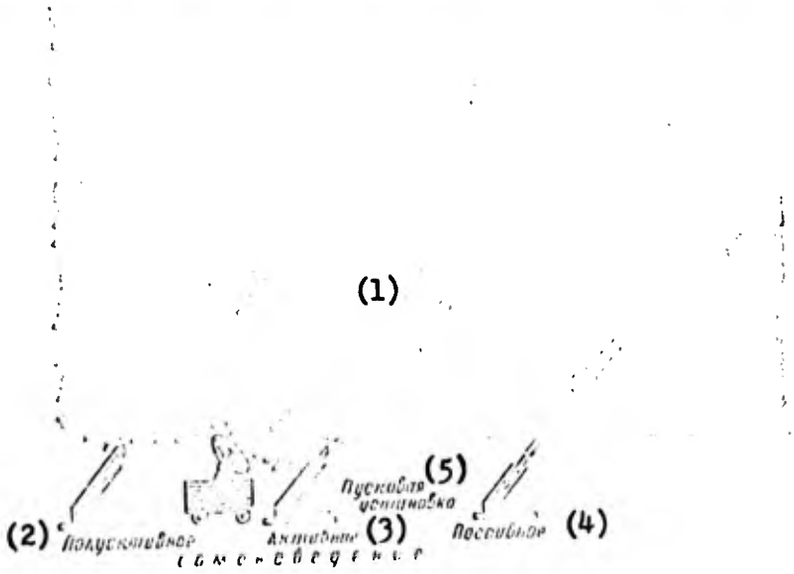
(B) Схема радиокомандного управления с двумя следящими радиолокаторами

Key: B. Diagram of radar command control with two radar units; 1. Three different moments of the location of the target and the missile; 2. Radar unit following the missile, computer, and the transmitter of the control signal to the missile; 3. Launcher; 4. Radar unit following the target.

GRAPHICS NOT REPRODUCIBLE

Homing guidance is effected by special equipment which is located in the head section of the missile. The chief element of this equipment is the homing head which operates on the principle of receiving thermal or radar emissions. It is also possible to home missiles in on other sources; for example, sound oscillations, light sources.

Three types of homing guidance systems are distinguished on the basis of their principle of operation: active, semi-active, and passive. In all of the homing guidance systems the missile control signals are worked out by the equipment which is located in the missile.



(C) Схема полуактивного, активного и пассивного самонаведения ЗУР

Key: C. Diagram of semi-active, active, and passive homing guidance; 1. Target tracking radar; 2. Semi-active homing guidance; 3. Active homing guidance; 4. Passive homing guidance; 5. Launcher.

Active homing guidance is based on the principle of the irradiation of a target by means of a radar unit located on the missile, with the subsequent reception of impulses reflected off the target. The latter are received by a radar station receiver which works out the control commands.

Semi-active homing guidance is also based on the principle of using a signal reflected off the target for determining the direction to the target. It differs from active homing guidance only in the fact that the target is irradiated, as if it was being illuminated by a powerful searchlight from the land-based radar station.

Passive homing guidance is based on direction finding with the radio, thermal, light, and other emissions from the target by a sensitive of the anti-aircraft missile's homing guidance head. The shortcoming of

passive homing guidance is that when the target ceases to produce emissions the homing guidance system does not work.

The combined control systems make use of a combination of anti-aircraft missile guidance systems. At first, use is usually made of one of the telecontrol systems: guidance by a radar beam or by a command system. At the final section of the trajectory, when the missile nears its target, the homing guidance head begins to operate. A combined guidance system makes it possible to achieve the most reliable hit on an aerial target.

The destruction of ballistic missiles while they are in flight is a very difficult problem. The distinctive features of a ballistic missile as a target are its great flight speed, great distances, the small size of the target, and the missile's movement, with the exception of the initial section, along a ballistic curve (along the trajectory of a free-falling body). Under these circumstances, the selection of a system and method of missile guidance is of the greatest importance in the destruction of a ballistic missile. In the opinion of foreign military specialists, the telecontrol system is the most effective system for guiding anti-missile missiles to ballistic targets. In their opinion, only it is capable of ensuring the interception and destruction of a ballistic missile at a great distance.

Non-contact fuses are used for exploding the warhead of an anti-aircraft guided missile as it approaches its target. Radio engineering fuses are the most widespread; they are divided into passive, semi-active, and active depending upon the location of the source of the radio waves. Radio fuses are used in most of the anti-aircraft guided missiles with which foreign armies are armed. In order to eliminate the possibility of unexploded missiles falling to the earth, they are all equipped with self-destructors which explode the warhead if the target is missed.

The radar station is a most important element of an anti-aircraft missile or an anti-missile missile complex. A subunit may have several such stations. Thus, for example, the American "Nike-Zeus" anti-missile complex contains a target designation (detection) radar station with a range of 1,600 kilometers, an identification (selection) radar station with a range of up to 800 kilometers, a target tracking radar station with a range of determining the parameters of a ballistic missile's warhead of up to 1,000 kilometers, and a guidance radar station which is designed for the automatic tracking of an anti-missile missile over a distance of up to 400 kilometers. In another, later system of anti-missile defense, the "Nike-X" system, it is planned to have two radar stations: a multi-purpose radar unit of the MAR type with three antenna systems which are designed for receiving reflected signals and transmitting powerful high frequency signals, and a missile tracking radar unit of the MSR type.

The most important tactical and technical characteristics of the

anti-aircraft missile forces radar stations are: maximum and minimum altitude and distance ranges, the limits of measuring a target's coordinates, resolving power for emitted high frequency energy, wave length, frequency of impulse repitition, width and form of the diagram of directivity, and anti-interference features. Radar stations which are part of the missile complex of an anti-aircraft or anti-missile defense are designed to detect targets, determine their coordinates, and identify, track, and guide missiles.

According to data in the foreign press, depending upon their function, the operational range of such radar stations goes from several hundred to several thousand kilometers.

A high degree of precision in determining a target's coordinates is of great importance, especially for radar guidance stations. According to the foreign press, modern detection and guidance radar stations determine the distance and altitude of a target's flight with great precision.

By a radar station's resolving power is meant its ability to distinguish signals from targets which are located at a certain distance from one another. The greater a radar unit's resolving power, the clearer the picture of the air situation that is reflected on its screens will be, and the easier it will be for a commander to analyze the situation and make the correct decision.

The resolving power of a radar station is determined for distance and angular coordinates. A radar station's resolving power for distance is determined primarily by the length of the transmitter's impulses. The briefer the impulse, the greater the resolving power for distance. The resolving power of a radar station for an azimuth is determined mainly by the gap of the antenna device's diagram of directivity on a horizontal plane, and for the angle of location -- on a vertical plane. The smaller this gap, the greater the resolving power.

The high degree of effectiveness of the anti-missile forces and their ability to fight successfully against the means of air and space attack has made it necessary to create means of fighting against them and to seek ways and means of creating hindrances to the work of radar stations. Thus, the American aggressors are using a "Shrike" anti-radar missile to fight against the radar equipment of the anti-missile forces and anti-aircraft artillery of the army of the Democratic Republic of Vietnam. These missiles are equipped with a homing guidance head and may be launched to altitudes ranging from a low-level flight to an aircraft's ceiling.

All armies are also devoting a great deal of attention to creating hindrances to the work of radar stations and anti-interference features for their radar. The interference which is created by the work of radar stations is divided into active and passive interference.

Active interference is created by special equipment -- interference transmitters, -- while passive interference is created by means of artificial reflectors (angle reflectors, metallized bands). In addition to specially created interference to the work of radar stations, sources of fortuitous active interference may also exercise an influence: nearby radar stations, radio transmitters, and other radar devices which operate on the same wave as the radar station of the missile or anti-aircraft complex. Fortuitous passive interference may arise as a result of the reflection of radio waves off local objects: mountains, high structures, clouds, etc.

Various means are employed for defense against active radar interference. The radar may be shifted to one of the reserve frequencies and in this way be spared interference. Anti-interference may be increased by narrowing an antenna's diagram of directivity, as well as by means of special protection schemes or by increasing the power of the radar station's transmitter.

Defense against passive interference is based on the use of the Dopler effect whose essence is that if an immobile and a rapidly moving object are in the zone of a radar's emission, the reflected signals will have different frequencies. Observing the indicator screen, a radar station operator may come to a conclusion about the character of a target by the frequency differences. Other methods of defense against passive interference are also used: in particular, the compensation method which makes it possible for all of the signals which are picked up by the receiver to be held in a special compensation block until the arrival of the following signals which are reflected from the same targets or local objects. By comparing these signals, their differences are transmitted to the station indicator. In this case the signals which come from moving targets will be clearly visible, while the signals which come from immobile local objects will destroy one another and will not be seen on the screen. It follows from this that the defense of radar stations against interference has to be conducted in two directions. First, by means of creating protection equipment for radar stations; secondly, excellent training for radar station operators and special training for work in the face of interference plays an important role in the work of radar stations that are subject to interference.

The launchers are the next very important element of an anti-aircraft missile complex. They are designed for launching anti-aircraft missiles. Pre-firing tests and the preparation of the missile are also done at the launcher.

Depending upon the place of the launching, the launchers may be land based or ship based. Land-based launchers are divided into stationary and mobile launchers. The launching of missiles is effected with guides which have various designs (frame, carriage). The launchers are aimed automatically. Launchers are located at firing positions which are equipped with engineering facilities. Thus, for example, a firing

position which is occupied by a battery of "Nike" anti-aircraft guided missiles consists of launching sites, underground warehouses, a power station, fuel warehouses, and facilities for assembling the missiles and testing the equipment. Every launching site has four launchers.

A large number of models of anti-aircraft missiles already exist or are undergoing tests for the PVO forces, land forces, and navy ships of most of the capitalist countries. The "Nike-Zeus" -- a long-range anti-aircraft guided missile -- is the most characteristic of them. It has the following tactical and technical data: a maximum range of 320 kilometers, an altitude range of 150 kilometers, and a flight speed of M equals 4.* The "Nike-Zeus" missile consists of three stages with engines that operate on hard fuel and it has a nuclear warhead. According to the reports of the American press, it is planned to use the "Nike-Zeus" missile for anti-missile defense.

The "Nike-Hercules" anti-aircraft guided missile is designed for destroying aerial targets at medium and great altitudes. It has the following tactical and technical data: a firing range of more than 130 kilometers, an altitude range of more than 30 kilometers, and a flight speed of M equals 3.35. The "Nike-Hercules" missile has two engines which operate on hard fuel and an ordinary or nuclear warhead.

The "Hawk" anti-aircraft guided missile is designed for destroying aerial targets at low and medium altitudes (from 150 to 1,500 meters), has a firing range of 35 kilometers, and a flight speed of M equals 2.8.

The American infantry, marines, and airborne troops are armed with the "Red Eye" manual anti-aircraft missile complex for the immediate defense of small subunits against air strikes. It consists of a missile, a launching rifle, and a control and testing instrument; it weighs 12.7 kilograms and is carried by a single soldier on his back. It has the following tactical and technical data: a range of 3,600 meters, an altitude of up to 3,000 meters, and a flight speed of M equals 2. The missile has a passive intrared homing head.

In the opinion of foreign military specialists, anti-aircraft missile complexes are the basic means for the anti-aircraft defense of naval ships.

Depending upon their firing range, ship anti-aircraft missile complexes are subdivided as follows: long-range anti-aircraft missile complexes, medium-range, close-range, and self-defense.

The "Thalos" missile, with which certain American heavy and light cruisers are armed, is a long-range ship anti-aircraft missile complex. It has a firing range of 100-185 kilometers, and an altitude range of

* M is equal to the speed of sound -- 333 meters per second.

27 kilometers. Guidance is effected by a semi-active homing control system.

The "Terrier," "Sea Slag," and "Mazurka" are medium-range anti-aircraft missile complexes.

Some of the aircraft carriers, cruisers, and frigates of the United States Navy are armed with the "Terrier" anti-aircraft missile complex. It has a firing range of 36-40 kilometers and an altitude of 27.5 kilometers.

The "Tartar" is a close-range anti-aircraft missile complex which is part of the armament of American cruisers, and American, Italian, West German, and Japanese destroyers. It has a firing range of 23 kilometers, and an altitude range of 20 kilometers. The guidance of the missiles onto aerial targets is effected by means of a semi-active system of homing control. The capture of the target by the homing head is effected before the launching. This increases the probability of hitting the target and the rapidity with which the anti-aircraft missile complex is fired.

The "Chapparel" missile, with which cutters and landing vessels are armed, is a ship self-defense anti-aircraft missile complex. It has a firing range of 4 kilometers, and a flight speed of M equals 2.5. The complex employs a "Sidewinder" "air-to-air" missile with an intrared homing head.

Anti-aircraft guided missiles are presently the basic means for anti-aircraft and anti-missile defense. Their further development in the capitalist countries is taking the direction of the creation of more powerful systems with a greater altitude and distance range, increased flight speed, and greater maneuverability and anti-interference features.

According to the data of the foreign press, a great deal of work is being done to create anti-aircraft missiles for anti-missile defense. Our country has successfully solved the problem of intercepting and destroying ballistic missiles in flight. Models of anti-missile weapons which are capable of striking an enemy's ballistic missiles at great distances from targets being defended were demonstrated at the military parades in Moscow in 1964-66.

In the opinion of American military leaders and scientists, the basic problems of developing an anti-missile system are the identification of a target among a large number of false targets, anti-interference against radio counteraction, an increased precision in the guidance of anti-missiles and increased firing potentialities for the anti-missile system, neutralizing the influence of the explosions of an anti-missile's nuclear warhead on the operation of radar stations, other elements of the defense, and on the well-being of defended targets, especially populated

points, and a simplification and cost reduction of the system.

A great deal of research is being done in the field of creating anti-aircraft guided missiles which are designed for fighting airplanes and missiles which operate at low altitudes.

A great deal of attention is also being devoted abroad to the creation of light self-propelled and transportable anti-aircraft missile systems like the American "Chapparel" and "Red Eye" systems which are designed for covering land forces which are operating in isolation from the basic forces, and also for strengthening anti-aircraft missile defense for low altitudes.

A large amount of work is being done in the Soviet Union on anti-aircraft missile technology. It has been pointed out in the central press that new highly effective anti-aircraft missile systems have recently been developed and adopted in our country. The combat potentialities of these weapons makes it possible to hit all modern means of air and space attack at all altitudes and supersonic flight speeds, under any conditions of the year and day, and despite radio interference.

Thus, modern anti-aircraft missile technology makes it possible to create a reliable system of anti-aircraft defense both in a theater of military operations, and in the country as a whole.

Combat Applications of Anti-Aircraft Guided Missiles

A country's anti-aircraft defense is created before it is needed, in peacetime. It represents a single system which consists of various means of anti-aircraft, anti-missile, and anti-space defense. These means defend in the first place the most important administrative and political centers, industrial areas, communications, power systems, large hydro-engineering installations, and other targets and areas of a country which are of great importance for the life of the state and for its defense capacity.

Consequently, repelling mass strikes of an enemy's means of air and space attack will be effected by the united efforts of all the forces and means of anti-aircraft defense.

The anti-aircraft missile forces have a very important role in destroying an enemy in the air.

In order to defend a country's targets and areas against air strikes by an enemy, anti-aircraft missile batteries occupy combat formations. Batteries are usually located around a defended target at its distant and near approaches. The distance depends upon many indices, and, above all, on the tactical and technical data of the anti-aircraft missile complexes and their number, and also upon the characteristics of the aerial targets and the means and methods of their combat employment.

The firing positions of anti-aircraft missile batteries are equipped with engineering facilities and are carefully camouflaged; railroad sidings are prepared along which the missiles and other material resources are brought up. The selection of a firing position and its equipment and camouflaging are of great importance for the combat operations and invulnerability of a firing position. When the American air force makes raids in Vietnam, it peforms a careful reconnaissance of the country's targets before making air strikes against them, and often uses special pilotless intelligence aircraft for this purpose. Discovering the location of anti-aircraft missile and artillery batteries is one of the most important missions of reconnaissance. Only after the necessary information about a target's PVO system is obtained is a bombing raid planned and carried out.

A large number of aircraft are assigned for destroying anti-aircraft missile and artillery batteries. Operating from low altitudes and dive bombing, they hit firing positions and attempt, above all, to put radar stations and launchers out of order. They use cannon fire, aircraft and napalm bombs, and unguided missiles for their strikes.

"Shrike" anti-radar missiles which home in on emissions are frequently used to destroy radar stations which detect and track aerial targets.

The destruction of aerial targets by anti-aircraft guided missiles is effected in approximately the following manner. When data is received about an aerial target from an early detection and warning system the senior commander orders the anti-aircraft missile batteries to be put in complete combat readiness. When the target appears in the detection zoı of the anti-aircraft missile subunit's radar stations a more precise reading of it is made. First of all, a determination is made of the nature of the target, its altitude, speed, and the direction of its movement.

When a target is detected the missile is prepared for launching, and when the aerial target enters the striking zone the missile is launched. The destruction of a single target does not present any special difficulties for anti-aircraft missile subunits, and, as a rule, an airplane or winged missile is hit with the first missile. The situation is more difficult when it is necessary to fight against several targets which are operating from various directions, at various altitudes, from the lowest to the highest, and which employ radio interference and maneuvers against anti-aircraft defense. Great art is required here from the firing commander, the aiming officer, and the radar operators, and the entire battery personnel has to have a high degree of combat training.

Automated guidance systems are used for guiding anti-aircraft missile subunits and units. Thus, American anti-aircraft defense uses the "Missayl Master" automated electronic system for guiding the anti-aircraft

missile batteries which defend large cities. It coordinates the firing of anti-aircraft missile batteries: it provides for the concentration or distribution of fire on targets, does not permit targets to get through to the defended object, and also does not permit their own fighters to be shot at by the anti-aircraft missile batteries. This system ensures the collection, processing, and transmission of all the information necessary to the battery commander and the group of batteries to make a decision on destroying aerial targets. One of the most important pieces of information which is received by the commander is information on targets at which fire is being directed. This makes it possible to organize and effect interaction with other firing equipment.

The organization of anti-aircraft missile defense for land forces has its own important characteristics. This follows above all from the character of the forces' operations. If the forces are on the defense, the anti-aircraft missile subunits are used for covering troop groupings, command points, large bridges and crossings, warehouses, and other facilities which are of great importance for operations and for the battle. The combat formation of the anti-aircraft missile subunits is constructed so as to cover troops and other objects from any direction. Depending upon the forces and the equipment, a zonal or an object defense may be created. With a zonal defense, an entire area is covered.

Just as with the PVO forces, the anti-aircraft missile subunits of land forces are located at firing positions which are well equipped with engineering facilities. The radar aiming stations, the launchers, the missiles, and the thrust equipment are concealed in trenches and carefully camouflaged from air and land observation. The guidance of the anti-aircraft subunits' fire is effected from command points.

In an offensive, anti-aircraft missile subunits and units are used primarily for covering the basic troop groupings which are carrying out the main mission, as well as the most important targets of the rear. During the course of an offensive troop groupings will change. This will require a change in the anti-aircraft missile covering. Some of the anti-aircraft missile subunits will be moved together with the attacking troops and, therefore, at certain times will not be able to take part in repelling enemy air raids. During this period a number of foreign armies use self-propelled anti-aircraft missile installations and transportable anti-aircraft missile systems like the "Red Eye" for the direct covering of attacking troops. Multi-barrel anti-aircraft artillery complexes have to play a great role in covering front-line detachments, as well as units that are on the march. Operating in close interaction with the subunits of the anti-aircraft missile forces, they are capable of destroying enemy aircraft, expecially those operating at low and extremely low altitudes. In addition, operating together with anti-aircraft missile subunits, small caliber anti-aircraft artillery protects them against low altitude enemy air strikes when they are on a march or when they are located at their firing positions.

The guidance of anti-aircraft missile subunits during an offensive is effected from highly mobile command points.

Interaction between anti-aircraft missile units and fighter aviation during an offensive becomes very important. Fighter aircraft which possess a long range are usually used for destroying aerial targets at the distant approaches to objects. Anti-aircraft missile subunits destroy the enemy in the air when he enters the striking zone of anti-aircraft missile complexes. When fighters and anti-aircraft missile forces operate jointly in a single zone, provision is made for a concentration of their efforts on targets. If an aerial target is attacked by fighters, anti-aircraft missile subunits do not fire at it. When fire is being conducted by anti-aircraft missile subunits, fighters do not fire at a target. Fighters may be given the right to unlimited operations in an anti-aircraft missile zone only when anti-aircraft missile subunits are deprived for certain reasons of an opportunity to conduct fire. There has to be a reliable system of identification for the successful operations of fighter aircraft and anti-aircraft missiles.

Life and Combat Training of Anti-Aircraft Gunners

One of the most important characteristics which defines the entire life and combat training of anti-aircraft missile gunners and anti-aircraft artillery gunners is the fact that they are on a constant combat watch which in peacetime involves the performance of a combat mission.

Due to the fact that they are directly at firing positions at their battle places at radar stations, guidance panels, and launchers, the soldiers of our anti-aircraft missile batteries can at any moment open up an overwhelming fire and destroy any enemy who attempts to invade the air space of our country.

In order to successfully perform a combat watch it is necessary to have a good knowledge of one's combat equipment, to know how to prepare it for battle and to wage a battle, to know how to rapidly eliminate defects when they arise, and to know a probable enemy's means of air and space attack and his operational tactics.

Thus, the performance of combat watch requires that soldiers, sergeants, officers, and generals have excellent training, a high level of discipline, vigilance, endurance, and personal responsibility for their work.

The anti-aircraft missile forces and the anti-aircraft artillery are armed with highly perfected arms and combat equipment. As the amount of equipment in units and subunits grows, the number of military occupations greatly increases. Whereas during the First World War there were 16 specialties in an anti-aircraft artillery battery and 34 in the Second World War, this number has now undergone a substantial increase. The anti-aircraft missile forces have three times as many

specialties as the anti-aircraft artillery. At the same time, the incapacitation of a single specialist can be fatal and can result in an entire subunit not performing its combat mission. This applies especially to such specialists as the firing expert, the aiming officer, the radar station operator, and others.

Due to this, it has become extremely necessary not only to be an outstanding expert in one's established specialty, but to also have a mastery of two or three related specialties, and to have a good knowledge of and be able to do combat work at stations, and with instruments, apparatuses, units, and blocs which have various functions and structures.

The Great Patriotic War showed that a soldier has to always be prepared to replace his comrade in battle and perform his duty in a battle crew, or on a gun or instrument. Therefore, the matter of interchangeability is of very great importance and it is usually worked out during the training and organization of battle crews.

The combat equipment with which the anti-aircraft missile forces and the anti-aircraft artillery is armed is very complex and requires constant attention and watching, as well as a great deal of knowledge which is connected with its operation, adjustment, and combat application. Its study is made easier by the fact that the army is now getting competent reinforcements, the vast majority of which have a general secondary and often a technical secondary education, while some of the draftees have a higher education.

The study of equipment and military subjects is made especially easy by the young people who studied in the various DOSAAF circles before they came into the army.

On has to work a great deal and persistently to have a perfect mastery of equipment and an ability to work with it. The level of knowledge and the practical skills of soldiers, sergeants, and officers is determined by their class ratings. A great deal of intensive work is presently being done to develop specialists with high class ratings. Specialists with class ratings are the pride of a unit and subunit. The larger the number of specialists with class ratings, the greater the combat training and combat readiness of the forces. In a number of anti-aircraft missile units and subunits the majority of soldiers and sergeants are specialists with class ratings, while all of the officers are specialists with high class ratings. Thus, for example, in 1966 more than 70 percent of the soldiers in the subunits which are commanded by the officers V. Meshkovtsev, O. Kolevskiy, and V. Mirgorodskiy were specialists with class ratings, and 50 percent of them were 1st and 2nd class specialists.

Anti-aircraft missiles and anti-aircraft artillery are collective weapons. The success of a battle depends upon the coordinated work of

each number of the battle crew and of the battle crew as a whole. This is why every soldier not only has to have an excellent knowledge of the combat equipment with which he works and the ability to work, but also a great deal of everyday training in a precise and timely performance of his duties which is brought to the point of being automatic.

Despite the enormous space in which it is waged, a modern battle with an enemy in the air is rapid. This is explained by the great flight speeds of modern means of air and space attack which results in the fact that a target is in the striking zone of anti-aircraft missile forces and, especially, anti-aircraft artillery for a very short time. Sometimes there is only enough time to make several missile launchings or fire several anti-aircraft artillery volleys. This is why the time element is of paramount importance in the anti-aircraft missile forces and the anti-aircraft artillery.

A fight for seconds and a fraction of a second in the combat work connected with putting a battery in complete combat readiness and conducting firing, meeting the norms in performing regulations work, and hitting a target with the first missile and the first volley is constant and persistent work in all subunits. We have many firing experts who have achieved the accomplishment of a combat mission -- hitting a target with the first missile.

All of this is being achieved as a result of persistent training in classes, in parks, on the field, at tactical exercises, and at firing ranges.

Extensive use is made of overall training which promotes a high level of training in the soldiers and their rapid mastery of combat equipment.

Training classes in the most important military subjects have been created in every subdivision for the training of the personnel. The training classes are equipped with special trainers, models, and electric diagrams which graphically reflect the processes that take place in the various combat equipment systems and units. This makes it possible for the personnel to master their basic and related specialties more effectively and with the smallest expenditure of time for training.

A great deal of attention is devoted to tactical training. Exercises are its concluding stage. They are conducted under complex conditions which approach a battle situation. Here is an example of conducting exercises like these under the conditions of the Far North. "The deep polar night. It is very cold. A squall is blowing and carrying snow. The subunit commander, Major V. Koydash, has received the mission of bringing a column of vehicles to the launching position. Traffic conditions were extremely difficult. The headlights came up against a dense wall of falling snow. But the column arrived at the position precisely at the established time. The communist Lieutenant B.

GRAPHICS NOT REPRODUCIBLE

Kondrat'yev and the komsomol member Sergeant V. Simanovskiy took turns laying out the route for the column on skis. This is the way they covered 20 kilometers."*

A large number of problems are usually worked out at tactical exercises. The most important of them are: the organization and accomplishment of a march in various air and land situations, occupying and changing firing positions, and repelling air and land attacks by an enemy. In addition to technical and tactical training, the soldiers have lessons in Marxism-Leninism, physical culture and drill exercises, and lessons on the regulations, fire arms, and many other subjects.

After every lesson and every unit of combat work a detailed analysis is made; the work of each crew and specialist is analyzed. A great deal of attention is devoted to individual work.

Anti-Aircraft Missiles on the March

Soldiers with long service give great assistance to commanders in training young specialists.

* "Missile Defense of Our Air Frontiers," Krasnaya Zvezda, 18 November 1966.

Technical circles are established, and question and answer evenings, various competitions, and other measures are conducted to raise technical and special training in the subunits.

The entire life and training of soldiers in subunits is arranged in strict accordance with the regulations and a daily schedule which is established by the commander. This disciplines and unites the soldiers, increases their responsibility for the common cause, and strengthens their military friendship. For their entire lives the years which they have spent in the army remain as a bright recollection in peoples' memories.

The intense military labor of the soldiers is given great recognition by the Communist Party and Soviet government. Every year many generals, officers, sergeants, and soldiers are awarded orders and medals for excellent indices in combat and political training and for the successful mastery of new equipment. In 1966 we see among those who have been awarded government orders the commander of a missile squardron, Senior Technical Lieutenant Shchechilin -- an officer with an excellent rating in combat and political training, an expert at his work, and an excellent educator of his subordinates.

While working persistently to increase their military, technical, and political knowledge and performing their severe combat service in heat and cold, day and night, in the Far North, and in mountains and deserts -- everywhere where the homeland requires it, -- at the same time, our anti-aircraft gunners live a full life together with our whole people. They make a deep study of the decisions of our Party's congresses and of the decrees of the Central Committee CPSU and the Soviet government, and take active part in collecting the harvest, in the construction of houses and roads, and in the elections to the higher bodies of the Soviet government and to local Soviets. Anti-aircraft gunners maintain contact with government, Party, and komsomol organizations in those areas where they perform their combat service and take an active part in their work, they organize visits to theaters, go on excursions, engage in sports, maintain close relations with kolkhozes, sovkhozes, factories, and plants, and hold joint meetings at which work experience is exchanged. Our country's distinguished people, the veterans and heroes of battles and labor, and the leaders of government, Party, and komsomol organizations are desired guests and frequent visitors among the soldiers.

Political organizers and Party and komsomol organizations are performing a great deal of work on the ideological education of the soldiers. They help commanders in the training and education of the personnel of units and subunits, in the successful mastery of complex combat equipment, in strengthening military discipline, and in increasing the combat readiness of the troops.

Communists and komsomol members demonstrate examples in mastering equipment, have excellent ratings in combat and political training,

help those who are lagging behind, and struggle for the title of excellent subunits and units. Many of them have several badges for soldierly valor which have been received for having attained an excellent mastery of their specialties.

A large amount of knowledge is necessary for a perfect mastery of combat equipment. Only an excellently trained officer and a specialist with a high rating is capable of teaching his subordinates great expertness in military work. Our officer cadres are highly educated and technically trained specialists. It is sufficient to say that more than half of the officers of the anti-aircraft missile forces and the anti-aircraft artillery have a technical engineering education. Every fifth officer has a higher education. There is an entire network of military educational institutions, including military academies and higher military engineering schools which are located in the large cities of the Soviet Union, for the training of anti-aircraft officers. The schools admit sergeants and soldiers who are performing regular or re-enlisted dutyand civilian youth from 17 to 23 years old whose health is suitable for service in the army and who have a secondary education. Young men who have graduated from a secondary school with a gold or silver medal are enrolled in schools without examinations.

The activities of the Voluntary Society for Assistance to the Army, Air Force, and Navy are of great importance for increasing our homeland's defense capacity. DOSAAF organizations do a large amount of work in educating the youth in a patriotic spirit and in disseminating military and military-technical knowledge.

The knowledge of radio electronics, mechanics, jet, and other equipment which is obtained by the youth before it comes into the army makes it much easier for it to master the complex equipment with which the anti-aircraft missile forces and the anti-aircraft artillery is armed. Experience shows that, as a rule, DOSAAF graduates have excellent ratings in the army in combat and political training. On the other hand, young people who have served in the anti-aircraft missile forces and in the anti-aircraft artillery become skilled specialists and master other specialties which are extremely necessary for the economy.

Conclusion

Under the leadership of the Communist Party, the peoples of the Soviet Union are implementing the decisions of the 23rd Congress of the CPSU and are successfully laboring to realize the grand plans for communist construction in our country.

The peaceful labor of our people is being guarded by its Armed Forces whose first echelon contains the Anti-Aircraft Defense Forces with its mighty anti-aircraft missile equipment.

The Soviet Union has a leading role in the development of missile construction. It is far ahead of the most advanced capitalist countries. It is sufficient to recall that the world's first intercontinental ballistic missile was tested in our country in 1957, the first artificial satellite was launched in the USSR on 4 October 1957, and on 14 September 1959 we were the first to reach the moon and put a pennant with the state emblem of the Soviet Union on it. On 12 April 1961 the world's first flight in a space ship was made in the "Vostok" by the Soviet astronaut Yu.A. Gagarin.

The Soviet Union has been successfully laying a path to the conquest of outer space and in the creation of powerful new missiles, including anti-aircraft guided missiles of various functions.

The soldiers of the anti-aircraft missile forces and the anti-aircraft artillery are improving their combat skills every day, are tirelessly increasing the combat readiness of units and subunits, and are mastering the art of hitting the enemy with the first missile and the first volley. The ranks of specialists with class ratings and of soldiers with excellent ratings in combat and political training are growing, and the number of excellent units and subunits is increasing.

Every year our glorious youth enters the ranks of the anti-aircraft missile forces and the anti-aircraft artillery. In order to master the complex specialties of an anti-aircraft gunner more rapidly, it is necessary to train oneself well in a technical respect in good time, even before entering the army. This knowledge can be obtained in the DOSAAF circles.

The Communist Party, the Soviet government, and the Soviet people have given the soldiers of the anti-aircraft missile forces and the anti-aircraft artillery powerful weapons which in skilfull hands are capable of delivering a crushing blow against an enemy in air or space and of destroying him, if he attempts to disturb the peaceful labor of our people which is building communism.

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13. ABSTRACT

This article is divided into the following sections: Introduction; Brief Essay on the Birth and Development of the Anti-Aircraft Artillery and on Its Combat Applications; Modern Means of Air and Space Attack and the Possible Character of Their Use; Birth and Development of Anti-Aircraft Missile Forces; Combat Applications of Anti-Aircraft Guided Missiles; Life and Combat Training of Anti-Aircraft Forces, and the Conclusion.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Anti-aircraft artillery Anti-aircraft missiles						

TECHNICAL TRANSLATION

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ANTIAIRCRAFT MISSILE FORCES AND ANTIAIRCRAFT ARTILLERY

by

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Source: ZENITNYYE RAKETNYYE VOYSKA I ZENITNAYA ARTILLERIYA, IZDATEL'STVO DOSAAF, Moscow, 1968, pp. 1-56

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