INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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NO FOREIGN DISSEM

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COUNTRY	USSR	REPORT	[redacted]
SUBJECT	English Translation of Herald of Antiaircraft Defense, Issue No. 8, 1963	DATE DISTR.	28 February 1964
		NO. PAGES	1
		REFERENCES	[redacted]
DATE OF INFO.	[redacted]		
PLACE & DATE ACQ.	[redacted]		

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[redacted]

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1. An English translation of Issue No. 8, August 1963, of the Soviet publication Vestnik Protivovozdushnoy Oborony /Herald of Antiaircraft Defense/, published by the Military Publishing House of the Ministry of Defense, Moscow [redacted]

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2. In some cases, the articles were translated in their entirety; in other cases, they were summarized. [redacted]

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[redacted]

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Herald of Antiaircraft Defense

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50X1

Vestnik Protivovozdushnoy Oborony, No 8, August 1963

TABLE OF CONTENTS

S-E-C-R-E-T

No Foreign Dissem

50X1

In Chasti and Podrazdeleniya of Our Forces

To New Boundaries (Page 2)

Abstract:

Reports a meeting held in a chast' to discuss training results and goals.

Interesting and Useful (Page 2)

Abstract:

Describes a visit to a collective farm taken by a group of military personnel involved in political work.

With an Evaluation of Outstanding (Page 2)

Abstract:

Reports training achievements of a radar podrazdeleniya commanded by Capt BARANOV. Officer KOPYLOV, Chief of a radar station crew, was identified as BARANOV's subordinate.

Assignment Completed -- Communications Established (Page 2)

Text:

Inclement climatic conditions in the Far North and within the Arctic Circle have an adverse influence on radio communications, especially on teleprinting operation, but military signalmen are finding ways of overcoming these difficulties.

A commander gave an assignment one day that communications be established with a remote post and that their continuity be ensured. Sr Lt GONCHAROV was selected to carry out the assignment.

For two days and nights, the officer did not leave the operations building, but the assignment given by the chast' commander was successfully executed. The causes of the teleprinter communications interference were found and corrected and the communications were established.

(A captioned photograph by I. RYBIN on page 2 shows Maj V. ROYEV, holder of the Medal for Combat Services, with several of his subordinates.)

Mighty Soviet Aviation -- by Mar Avn Ye. Ya. SAVITSKIY, Twice HSU (pages 3-8)

Text:

It has become a tradition in our country to observe Air Force Day yearly. On this national holiday, our country honors its glorious aviators who vigilantly guard the aerial boundaries of the Soviet Fatherland and the designers, technicians, scientists, and workers of aviation industry by whose efforts first-class aircraft are produced.

We will attempt to trace the growth, development, and strengthening of the mighty steel wings of our native land. We recall 1933 when Aviation Day was first celebrated by resolution of the Soviet government. At that time, the first Five-Year Plan was completed ahead of time and a great victory was gained on the industrialization front. It was precisely on that industrial foundation that the powerful aviation industry made its appearance. Many aircraft and motor manufacturing plants and enterprises producing aviation instruments, equipment, and armament, were built and put into operation. The Soviet country came to have the most perfect aircraft of that day, superior by far in performance characteristics to foreign aircraft.

While paying a great deal of attention to equipping aviation technically, the Communist Party was also educating aviation cadres enthusiastically. It assigned a significant number of Communists to aviation. Thousands of Komsomol members enrolled in schools, flying chasti, air clubs, and plants of the aviation industry. All this contributed to the development of aviation at a quick tempo and to the solution of a great and responsible task -- to fly farther, faster, and higher than all others.

In the chronicles of pre-war history, the feats of the pilots who saved the aircrew and members of the scientific expeditions from the steamship Chelyuskin (1934), the non-stop flight from Moscow to Udd Island (1936), the landing of the Arctic scientific expedition on the North Pole, and the non-stop flight from Moscow to the United States of America via the North Pole by the aircrews of V. P. CHKALOV and M. M. GROMOV (1937), are written down on golden pages.

In this period, military pilots, together with soldiers of the other service arms, presented an example of skilled and courageous defense of the Socialist Fatherland from the aggressive actions of its enemies. In skirmishes with the Japanese in the Hasan Lake region and the Halhin Gol River and in struggles against the White Finns, the winged warriors were true to their military duty to the end.

The might of Soviet Aviation, the heroism, the selflessness, and the military ability of our pilots were especially strong in the Great Patriotic War. In first-class combat aircraft, the glorious eagles of our Fatherland valiantly fought against the hated enemy, and accomplished many heroic feats for victory over Hitler's aggressors. The Fatherland highly valued the

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military exploits of her winged sons. Over 2,000 aviators were awarded the title Hero of the Soviet Union, 70 pilots and navigators received the title twice, and the famous pilots A. I. POKRYSHKIN and I. N. KOZHEDUB, today air force generals, became Thrice Heroes of the Soviet Union.

In the post-war years, the party directed the efforts of schools, aviation designers, engineers, and workers towards the creation of new, improved aviation equipment. As a result of their selfless labor, our industry mastered the series production of jet fighters and bombers which permitted arming the Air Forces and Fighter Aviation of PVO Strany Troops with absolutely perfect aircraft. Air Force personnel have persistently mastered the equipment and have employed it in combat training. Soviet pilots were the first in the world to accomplish individual and group piloting in jet fighters, the first to break the sound barrier, and the first to complete large numbers of long distance non-stop flights.

At the present time, our famous Soviet Aviation, including military aviation, is developing at an even faster rate. Speeds, altitudes, and distances are increasing, armament is being improved, and new control systems are evolving. It suffices to say that the speed of up-to-date aircraft now amounts to thousands of kilometers per hour and the ceiling exceeds 30 kilometers.

The Soviet people have achieved enormous success in mastering space. It seems not long ago at all that Yuriy GAGARIN broke the first trail through cosmic space; behind him, German TITOV completed a 24-hour flight -- 17 orbits around the earth. Later, the first multiple flight lasting more than a day was performed by the two cosmic ships of Andriyan NIKOLAYEV and Pavel POPOVICH. Then the world became a witness to a new triumph of the intelligence and genius of Soviet man. On June 14, the cosmic ship Vostok-5, piloted by Valeriy BYKOVSKIY, was launched into orbit; and on June 16, the courageous daughter of the Soviet country, Valentina TERESHKOVA, was launched into space on the ship Vostok-6.

The flights of BYKOVSKIY and TERESHKOVA once again demonstrated to the entire world what great heights Soviet science and technology has achieved in its development. The hearts of the Soviet peoples were filled with a feeling of great joy and happiness for their Communist Party and for the achievements of their country's science and technology which won a brilliant new victory. Aviators in PVO Strany Troops, together with all Soviet people, were delighted with the courage and valor of their compatriots, Pilot-Cosmonauts Col V. BYKOVSKIY and V. TERESHKOVA, whose feats will serve as a noble example of heroism and selflessness.

The Soviet nation has entrusted PVO aviators with first-class aviation equipment, powerful armament, the most complex radiotechnical equipment, and diversified navigational equipment for carrying out the honored task of defending the aerial boundaries of our native land. Our aviators appreciate this confidence and will spare no efforts to master the combat equipment and to perfect their skills.

Personnel of Fighter Aviation of PVO Strany Troops are greeting Air Force Day with new successes in combat and political training. Inspired by the historical resolution of the 22d Congress of the CPSU and the Program of the Communist Party, soldiers in the chasti and podrazdeleniya have achieved excellent results in combat training and in strengthening discipline, organization, and order as a result of widespread socialist competition. In an overwhelming majority of podrazdeleniya, flights are conducted strictly according to plan, accurately and instructively, and in complete accordance with the specifications of documents regulating flight service. The number of podrazdeleniya and chasti in which there have been no flight incidents or conditions leading to accidents for long periods of time has significantly increased.

The steadfast growth of the number of rated specialists and those outstanding in training is a vivid example of the patriotic aspirations of personnel of Fighter Aviation, their conscientiousness and aggressiveness. Today we have more and more podrazdeleniya in which all the pilots are capable of executing the most complex missions in any weather conditions, day or night. Is this not an indication of the combat maturity of our aviators and their readiness to inflict a destructive blow on an aggressor if he dares to invade the bright sky of our native land!

Pilots Maj NIKULIN, Capt ANDRIYETI, Capt SAMODUROV, Capt TOMASHIN, Capt ROSSOV, Capt SHISH', and others are highly thought of, for example. They have mastered combat aircraft to perfection, have learned to employ their performance characteristics to the fullest, and intercept aerial targets in complex weather conditions, day or night.

Successes in flight training are not possible without the efficient well-coordinated work of the specialists in aviation engineering services. The use of advanced methods in servicing complicated aviation equipment has ensured the execution of intensive work in chasti and podrazdeleniya and has provided long service for each aircraft. Capt Tech Serv ANDRIANOV, Tech-Sr Lt MOROZ, Tech-Sr Lt SAVENKO, Tech-Sr Lt NOSKOV, Tech-Sr Lt YANKAUSNAS, Tech-Sr Lt SMIRNOV, and others have become experts of aviation equipment and masters of maintenance.

Navigators and command post guidance officers, on whom success of flights in pursuit of an air target depends so much, are real aids to pilots. Capt RAZUMOV, Capt KUPTSOV, and Sr Lt FILIPPOV have mastered their specialties to perfection. A high feeling of responsibility for the assigned mission and competent, accurate work distinguishes them. When calculating fighter maneuvers, they not only lead the pilot to the point of departure but also try to create favorable conditions for his actions.

Excellent results in training and service were also achieved by the soldiers of aviation rear services. Capt SMABODNIKOV, Capt LEVCHENKO, Capt PILIN, M/Sgt SHIMAN, and many other soldiers of technical podrazdeleniya, for example, serve honorably and are models at discharging military duties.

While noting the successes achieved by personnel of Fighter Aviation, while honoring our outstanding aviation commanders, pilots, engineers, technicians, and mechanics, we do not at the same time have the right to ignore shortcomings. We still have them. In several podrazdeleniya, there are cases of violations of the rules for organizing flights. Here and there, oversimplifications and indulgences are committed in conducting flights on combat employment. Some commanders respond weakly to the minor infractions of their subordinates, forgetting that in the organization and conduction of flight work there are not trifles and that what seems an insignificant negligence can be the cause of a serious flight accident. The task is to eliminate these and other shortcomings more quickly.

Today intensive work is being conducted at our airfields. Aviators are solving great and complex tasks and are raising the combat readiness level of chasti and podrazdeleniya and their skills to new levels and achieving outstanding mastery of contemporary aviation equipment. All this demands much organizational work from commanders, staffs, and party and Komsomol organizations. First of all, care must be shown to conduct combat training sytematically, without slowdowns or speedups. In order to do this, combat training must be carefully planned and the course of its fulfillment strictly controlled. Everything must be directed towards ensuring timely and high quality fulfillment of combat training missions without flight accidents or conditions leading to them.

Special attention should be given to flight methods training of commanding personnel, for the higher the level of their professional skill, the more sound their practical skills, the more successful will be the mastery of complex aviation equipment and the means of its combat employment. With that end in view, it is very important to conduct training demonstrations and flights with commanders regularly and to publicize outstanding work experience more widely.

Being direct leaders of combat training and mentors of pilots, aviation commanders are obliged to improve the style of their work. In order to successfully cope with their obligations, they must not only know their specialty thoroughly, be politically mature, and methodically competent, but they must also display constructive initiative in work and have a sense of the new.

While worrying about a further increase in the combat skills of aviators, it is also necessary to continue strengthening one-man command, to instill in commanders daily a sense of high responsibility for the assigned mission, to maintain authority, and to strengthen their influence on subordinates. It is known that nothing increases the authority of a commander as much as his exactingness and the precise, prompt execution of flight rules. Commanders on all levels, political organs, and party and Komsomol organizations should persistently educate personnel in the spirit of high efficiency, and exact and faultless observation of the order and rules governing flight duty.

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Careful preliminary preparation for flight has great significance accomplishing combat training missions and executing flights without conditions which may lead to flight accidents. The nature and peculiarities of executing the impending flight mission should be examined during the preliminary preparation.

It is necessary to raise the quality of the execution of training, to bring it as close as possible to flying conditions, to avoid laxity and stereotypes. At training, each pilot must be required to explain all in-flight procedures and the causes of this or that mistake and the method of correcting them. The flight readiness of pilots must be checked more carefully. The check should be conducted not only after completion of the preliminary preparation, but also during preparation. This makes it possible to detect and eliminate shortcomings in personnel before the beginning of a flight.

Much remains to be done in improving the tactical skills of flight personnel. When improving elements of tactics, commanders and pilots are obliged to show personal initiative in searching for new tactical methods. Elements of tactics should be mastered with flight personnel not only in the process of tactical flight exercises and air force training, but, also, when executing routine flights.

Training pilots in conditions as close as possible to real combat situations is a method of further increasing their tactical training. Therefore, those commanders are correct who use each flight for mastering tactical missions and for teaching subordinates that which is necessary in a real air battle. The interests of training demand that commanders instruct pilots in conditions when the target takes evasive maneuvers. It is important that the pilot taking off to intercept an enemy does not know on what course the enemy is flying, what his flight altitude will be, etc. At the same time, the ground controller's actions, and especially his commands, must be such that they do not contain the pilot so that the pilot shows initiative in selecting tactical maneuvers for the interception. In other words, pilot training must be organized in such a manner that in each flight the pilot has the possibility of developing his tactical mastery and acquiring the practical skills of conducting a modern air battle, and learns to accurately destroy air and ground targets on the first attack.

High-quality preparation of aviation equipment for flight is an indispensable condition for successful fulfillment of the missions confronting Fighter Aviation. It is a matter of honor for engineers, technicians, and mechanics to maintain aircraft in readiness at any time of the day or night to take off on a combat mission. High organization in work on equipment, skillful execution of their duties by all specialists, careful inspections, and irreproachable fulfillment of repair with extensive usage of checking and measuring instruments and various kinds of devices, are necessary for t 50X1 Such preparation of aviation equipment for flight will prevent instances of aircraft with defects taking off and at the same time ensure the safety of their work in the sky.

The summer training period places increased demands on command posts. In this period, navigational provisions for the flights, the cooperation of pilots, navigators, and guidance officers during target interceptions should be especially efficient and reliable. Considering the great intensiveness of summer flights, it is necessary to raise the responsibility of staffs for precise planning of interceptions for each flying day.

The success of fighter pilot training and accident-free flight service depends to a significant degree on accuracy and coordination in the actions of soldiers of all services and specialties. It is, therefore, necessary to show constant concern for increasing the combat skills of personnel of rear and radiotechnical podrazdeleniya and for publicizing and introducing their advanced methods of work.

A powerful means of mobilizing personnel to successful fulfillment of the tasks confronting Fighter Aviation is socialist competition. When promoting it between pilots, technicians, mechanics, flights, and squadrons, it is necessary to achieve absolute fulfillment of commitments undertaken and on that basis, a steady growth of the number of outstanding airmen, rated specialists, and advanced podrazdeleniya and chasti.

In resolving all these tasks, further improvement of party political work in air force chasti and podrazdeleniya, and especially ideological work, which is a powerful means of increasing the political consciousness of soldiers and strengthening the combat readiness of chasti and podrazdeleniya, acquires an important significance. While implementing party instructions and executing decisions of the June Plenum of the Communist Party, commanders, political organs, and party and Komsomol organizations are urged to educate aviators unceasingly in the spirit of Marxist-Leninist ideals, unshakable devotion to military duty, conscious discipline, high vigilance, and constant combat readiness.

It is necessary to improve the organization of party political work with personnel in the period of flight preparation and execution. This should not be limited merely to aviation podrazdeleniya. In modern conditions, successful fulfillment of flight training plans is absolutely impossible without the coordinated work of the soldiers of aviation technical podrazdeleniya, radar station crews, and crews of ground navigational aid stations, command posts and weather service specialists. The matter must be organized so that each serviceman participating in the preparation and execution of flights is embraced by the party's influence. At the same time there must be constant concern for the soldiers' health, their daily regimen, nourishment, and physical conditioning. With this end in view, it is necessary to increase the exactingness toward administrative and medical personnel.

To develop the constructive activity of aviators in every way possible, to increase the outstanding role of Communists and Komsomol members in training and in service, and to mobilize all personnel to successful fulfillment of combat missions and political training -- these are the demands laid on all commanders, political organs, party and Komsomol organizations, these demands being dictated in the interests of high combat readiness for Fighter Aviation of PVO Strany Troops.

(A captioned photograph of Capt Ye. SHIYKO, Pilot 1st Class, by Z. SORKIN appeared on page 6.)

(A captioned photograph of Capt E. KASATKIN, Pilot 1st Class, by K. FEDULOV was published on page 7. Capt KASATKIN is regarded as the best interceptor pilot in his podrazdeleniye. He has excellent knowledge of aviation equipment and the means of its combat employment.)

<u>Military Educational Institutions On the Eve of the New Academic Year</u> -- by Col Gen Avn P. K. DEMIDOV (pages 9-12)

Excerpts:

Has everything been done in our vuzes (higher educational institutions) to equip young officers with a thorough knowledge of the laws of social development and a scientific Marxist-Leninist outlook which lights the way in the struggle for the triumph of Communism? Unfortunately, no. The organization of the study of Marxist-Leninist theory still contains essential shortcomings. Several chairs and departments have still not overcome elements of dogmatism and formalism. In a number of cases, the study of social disciplines is out of touch with the specific problems confronting the troops. In the new academic year, much must be done for a more thorough study of Marxist-Leninist theory and for improving the ideological educational work in vuzes. In this connection, we must constantly remember the instructions of the party given at the June Plenum of the Central Committee of the CPSU that a Soviet specialist must have not only the knowledge of an engineer or an agronomist, but, also, the heart of a patriot, a citizen of the Soviet Union....

Student and officer-candidate ideological training must proceed in indissoluble correlation with operational-tactical and technical training. Graduates of vuzes must have a sound knowledge of the means of air attack of the imperialist governments and the possible tactics of its employment.

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They must know the tactics of all branches of air defense in the event the aggressor employs nuclear rocket weapons. Only with such knowledge will an officer be able to make a tactically competent decision and utilize the armament at his disposal to the fullest. It should be noted that the level of operational tactical training of the graduates of our vuzes does not always meet the requirements of modern combat. This makes it necessary to search for new forms of teaching the mastery of organizing antiaircraft defense of a target and repelling raids of modern means of air attack which are widely varied in tactical and technical capabilities and means of employment.

In fulfilling the requirements of the Minister of Defense for improving the instruction of physics and mathematics to students and officer-candidates, vuzes have done some work in this direction. The general technical level of graduates has increased significantly. However, we cannot rest on these achievements. In the forthcoming academic year, it is necessary to improve instruction of physics and mathematics to students and officer-candidates. Unfortunately, some instructors of mathematics, physics, and other technical disciplines think that, within a course, it is necessary to give the students a maximum amount of mathematical learning. Hence, they force the students and officer-candidates to learn many formulas and theorems by heart, even those which are sometimes not directly connected with combat equipment or with a practical use of such knowledge by the troops....

In the forthcoming academic year, vuzes are confronted with the task of training high-quality cadres in a wide number of subjects. This means that future engineers must know how to utilize the entire system of a modern rocket, aviation, or radar complex and the future technician must know how to utilize one system of a given complex. This is a great and responsible task. Much effort from the faculty, the students, and the officer-candidates is required for its successful execution. That is why it is necessary to revise and make more exact the educational programs of general technical and special disciplines and connect them closely with the practical work of officers in units in the time remaining before the beginning of the new academic year....

A mere revision of the programs and an improvement of their individual sections is insufficient for the training of excellent officer dadres. It is also necessary to think about and find the most effective means of teaching. Particularly, programmed teaching using various cybernetic devices and machines is such a means. Some experience in their use is already known in our higher engineering educational institutions, where the teaching of some training groups was conducted in special classrooms in the past year by means of examiners, prompters, and other teaching machines. This experience must be generalized, thoroughly studied, and gradually introduced into the educational process, transforming entire courses and classrooms to programmed teaching.

Due to a number of reasons, we will not succeed in changing over to programmed teaching in all vuzes in the new academic year. Training devices, mockups, and other visual training aids, now available or in preparation, will have to be used for some period of time in the educational process.

Temporary duty assignments in units plays an important role in the practical training of students and officer-candidates. Unfortunately, there are some shortcomings in the program. The tasks assigned to the students on temporary duty assignments are not always specific. Chasti and podrazdeleniya commanders poorly check the work of the students and do not help them acquire command skills in organizing and conducting training and educational work with personnel.

In order to increase the amount of time allotted to independent study by students, it is necessary to shorten planned lessons intelligently and strictly regulate the work week. In this respect, there are already positive examples in our vuzes. Thus, in the Artillery Radiotechnical Academy, a 30-hour work week has been established for the senior courses and a 36-hour work week has been established for the first and second courses....

Our vuzes have everything needed for the successful training of young specialists to meet modern requirements. They have qualified faculty personnel and well-equipped laboratories. Abundant military experience in training and educating personnel is at their disposal. These capabilities must be used to the fullest so that the academies and schools graduate officers in the future who are worthy of the honored mission placed on the armed defenders of the Fatherland.

PARTY-POLITICAL WORK AND MILITARY EDUCATION

The Strength of the Komsomol Depends on Party Supervision -- by Lt Col B. N. GOROKHOVSKIY and Maj K. V. TIKHONOV (pages 13-16)

Summary:

The 45th anniversary of the Komsomol is approaching. The party has always given concentrated attention to supervision of the Komsomol. This fully applies to party organizations of the Armed Forces.

The party committee of a chast' criticized some of its officers who had given insufficient attention to the education of youth. Seminars were held for commanders and deputy commanders to train them in forms of education and supervision. As a result of these and other measures, many party members maintain regular contact with Komsomol organizations and guide their activities in carrying out tasks assigned to podrazdeleniya.

The principal form of supervision by a party organization consists of direct participation of party members in the work of Komsomol organizations. Therefore, the party committee should be constantly concerned with recruiting Komsomol activists into the ranks of the party. The percentage of party members in the Komsomol is constantly increasing.

A special school for Komsomol activists has been operating in a chast' for over two years. This school is attended by Komsomol committee members, secretaries and members of bureaus of primary Komsomol organizatitions, Komsomol group organizers, agitators, and editors of wall newspapers and pamphlets. Once a month they attend lectures, take part in discussions on party matters, study forms of working with young people, exchange experiences, and arrange excursions. However, the training of activists is not restricted to the school, or to seminars and conferences. Particular attention is given to immediate daily contact with party members who give practical advice and help in solving specific problems.

The party organization is greatly interested in the ideological and political education of youth. The party committee prepared a plan for readings from Lenin's works and gave advice on how to conduct them.

Officers of the chast' regularly give lectures in podrazdeleniya and hold discussions on military and political subjects.

Ideological work produces positive results when it is combined with daily practical efforts to acquire complete mastery of combat equipment and to maintain firm military discipline. Party members consider it their duty to give practical help to Komsomol members in their training and their performance of service duties, inspiring them to strive for perfection.

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The success of Komsomol work depends to a great extent on the ability of the commander and the party organization to recognize and support youthful initiative and create the proper conditions for carrying out useful undertakings.

For the purpose of improving party supervision of Komsomol organizations, it is very important to create in each party organization an atmosphere of general interest in Komsomol affairs, so that each party member would contribute to the education of youth not only from a sense of duty but because it is a matter of personal interest to him.

When Flights Are Held at Night -- by Lt Col M. S. KIRICHENKO (pages 17-21)

Summary:

Night flying is one of the most important and complex forms of combat training for aviators. No pilot can consider himself completely prepared to solve combat missions unless he has learned to intercept and destroy air targets at night.

In this article, the organization of party political work during the preparation and conduct of night flights in the chast' where Lt Col NOGAL' is a deputy commander for political affairs will be discussed.

On the Day Before the Flights

The most opportune time for conducting party political work with personnel is in the period of preflight preparation of aircrews and combat equipment for night flying.

The basic concern of the commander, his deputy for political affairs, and the party committee during preflight preparation is to see that the pilots thoroughly understand the missions, feel a sense of duty for fulfilling their obligations, and act with full concentration of their efforts.

After learning of the impending missions from the commander and studying the schedule chart, the deputy commander for political affairs formulates a plan for party political work. Then he and the secretary of the party committee meet with secretaries of the party and Komsomol organizations of the squadrons and maintenance podrazdeleniya, and talk with pilots directly in the podrazdeleniya, the classrooms, and on the flight lines.

During the preflight preparation for one night training session, for example, the political workers of the chasti and the political workers of the podrazdeleniya held a joint meeting. Lt Col NOGAL' explained the tasks assigned to the flights by the commander, discussed peculiarities of flying on that particular night, and completed the party political work plans.

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The political worker explained how to check the preflight rest periods and meals of aviators, directed attention to the effectiveness of publicizing outstanding pilots, and discussed safety measures.

Then the efforts of the political workers were divided. The deputy commander for political affairs took upon himself the organization of party political work among pilots and command post personnel, and the secretaries of the party and Komsomol committees undertook the organization of party political work among technical engineering personnel.

During preflight preparations, Lt Col NOGAL' checked on how the squadron commanders were readying their personnel for flight, instructed the secretaries of party organizations, and conversed with pilots about their flight readiness. At the command post, Lt Col NOGAL' was interested in the navigators' knowledge of the schedule chart, the flight routes, and the peculiarities of guiding each type of aircraft according to its altitude.

Members of the party committee and secretaries of the party organizations were also among the flight personnel, helping and advising them.

Secretaries of the party and Komsomol committees met with technical engineering personnel at the airfield throughout the preflight preparation period. They explained problems of night flying to the technicians and mechanics, selected and appointed group organizers of zones, and helped the secretary of the party organization of aviation and engineering services instruct agitators. Komsomol activists printed newssheets. The secretaries of Komsomol organizations conversed with each Komsomol member, paying especial attention to ground safety rules and preparations for second sorties.

Members of party bureaus and staff Communists talk to the radar operators, searchlight operators, radio operators, navigational aid specialists, fueling specialists, and drivers of special vehicles. Instruction booklets published by higher political organs are widely used.

The work of technical personnel is more difficult at night. The technicians must pay special attention to lighting equipment and the organization of meeting and towing aircraft in addition to checking the aircraft and conducting post-flight inspections.

Two lectures are read for pilots on the day before the flights -- on fighter tactical methods in night combat and on instrument flying. Engineering and technical personnel listen to a report on the peculiarities of servicing aircraft for night flying.

At the Airfield at Night

Experience shows that the most expedient form of party-political work in night flying is talking with pilots, and with technicians and mechanics, individually and in groups, and broadcasting news on the radio.

Workers and activists of the club set up visual propaganda displays at the airfield. The club's motor vehicle or radio-equipped trailer is used to house it. Various diagrams and reference materials related to the flight missions and instruction manuals are a great help to the pilots, technicians, and specialists. The radio makes it possible to inform personnel of the results of flights, interceptions and weather conditions, and to keep personnel in the course of the events.

The political workers and podrazdeleniya commanders at the airfield initiate measures to carry out the flight controller's instructions accurately and to eliminate shortcomings.

Agitators talk with the pilots preparing for flight, technicians, aviation specialists, and radar operators. The agitators have to prepare their talks carefully, since they are working in darkness and reference materials cannot be used.

About 45 minutes before takeoff, when the engines are already tested, and the weather recon plane has taken off, the radio begins broadcasting from the agitators' vehicle. Usually, the broadcasts concern the missions, the special difficulties of the flights, shortcomings in past flights and corrective measures.

At the end of the flights, the results of the night's work are broadcast. Those who were outstanding are praised and those lagging are criticized. The radio broadcast is such an important method of party-political work during night flying that it should be discussed further.

As a rule, the broadcasts consist of three parts. In the first part, difficulties and missions of night flying, results and shortcomings of previous flights, the duties of pilots, technicians, mechanics, and regulations from documents governing flight service are discussed. The significance of careful preparation for flight, the pilot's physical training, circumspection and cooperation are also discussed.

The second part of the broadcast concerns national and international news. In addition, experiences of the Great Patriotic War, the history of aviation, PVO Strany Troops, and of the chast' are narrated.

The third part is devoted to the life of the chast', the experience of outstanding trainees, rated specialists, competition results, and reviews of the combat newssheets. Satire and humor close the program.

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During the period of night flying described in this article, three broadcasts were given. The first, prior to takeoff, told about the problems of the impending missions and discussed the feat of Capt KARPENKO, Pilot 1st Class, who landed his aircraft safely after struggling to save it from a dangerous situation for 20 minutes.

The second newscast was given during the flights. In it, the aviators heard about the outstanding interceptions executed by Maj LOTIKOV, about the excellent piloting technique of Capt USKOV, and about the fast wheel change performed by Sr Sgt FANATOV and Pvt BASHKIROV.

The third newscast, given after completion of the flights, contained results of the night's missions. It goes without saying that strict military security was observed in the radio broadcasts.

What did the deputy commander for political affairs do during this time? Lt Col NOGAL' first of all briefed himself on the readiness of the airfield, the aircraft, means of communications and radio navigation, and the weather conditions. He spoke with the doctor about the pilots' health and then attended night pilot training sessions in the aircraft cockpits. He was interested in the pilots' moods and their knowledge of their specific missions.

After takeoff of the first aircraft, the efforts of the political workers and party activists were concentrated on readying aircraft for repeat flights.

The editorial board members of bulletin board newssheets and combat newsletters worked actively. They were constantly aware of how the flights were going, and they made notes about who was performing outstandingly. They also reported mistakes and shortcomings.

After the Flights

At the post-flight critiques, political workers and Komsomol and party committees report to the chast' commander and his deputies and to the chief of staff, on their work during the preparation and conduct of flights, and give evaluations on the effectiveness of oral propaganda, visual agitation, the press, and other means of political education work. After the critiques, the deputy commander for political affairs acquaints the party and Komsomol activists with the commander's conclusions on the flights and the party-political work done in this connection.

What can be said about the effectiveness of party-political work in the chast' in question? The pilots of the chast' completed the yearly plan for rate increases ahead of schedule. Seventy percent of their training load consists of flights in complex weather conditions and at night. There have been no violations of military discipline here and almost no instances conditions leading to accidents. The number of outstanding and rated specialists has grown.

In this article, only some party-political work methods in a chast' were discussed. They cannot, of course, be recommended as obligatory for every aviation chast'. However, all beneficial methods for providing flight safety and the outstanding performance of combat missions should be accumulated and widely publicized.

Once More in the Ranks -- by Maj (Res) I. N. SAVIN (page 21)

Abstract:

Praises the professional skill of Maj A. KLAKUN, a former pilot who now works as a GCA controller. KLAKUN, who is the head of a party organization, has more than 3,000 landings to his credit.

A captioned photograph taken by SAVIN of Maj KLAKUN and Jr Sgt I. SEZONENKO, GCA Radar Operator 1st Class, was published on page 21.

The Commander's Example Leads -- by Lt Col M. S. LEONOV (pages 22-26)

Abstract:

Praises the fighter aviation chast' commanded by Col Vasiliy Mikhaylovich SINYUKAYEV, a skilled organizer, educator, and an experienced pilot who leads subordinates by his example to new achievements in training. Last year the chast' was awarded two Red Banners, one from the Military Council and the other from the oblast' committee of the CPSU, for successses in combat and political training. The article contains specific examples of training and flight incidents illustrating Col SINYUKAYEV's commanding skill.

The following personnel were identified as serving in SINYUKAYEV's chast': Lt Col Ptr Vasil'yevich SHUTOV, chast' deputy commander for political affairs; Maj BIBIKOV, Squadron commander; Capts TIKHONOV, IL'ICHEV, and KULIK, pilots subordinate to BIBIKOV; Capt Tech Serv PLAKSIN, commander of technical operations chast', Tech Sr Lts NECHAYEV and MERKUSHIN, subordinates to PLAKSIN; Sr Lt SHEVCHENKO, flight controller; Maj LIKHTMAN; Capt KARABANOV; Capt MEL'NIKOV; Capt Tech Serv ISAYEV; Maj POTAPOV, Squadron commander; Capt SAYAPIN, subordinate to POTAPOV; Capt ZHAYVORONOK, pilot; Capt KOSTENKO, pilot; Capt ZIMIN, pilot; and Capt OSMININ, pilot.

(A photograph of Col V. M. SINYUKAYEV appears on page 24.)

COMBAT TRAINING

Carefully Train Operators With High Qualifications (pages 27-30)

Abstract:

Comments on the training of radar operators, noting that timely detection and plotting of air targets, accuracy of guiding combat weapons onto violators of air boundariers, and readiness of equipment for combat work depends greatly on the masters of this speciality; and praises commanders who require radar operators to study the entire armament complex -- not just the individual units and assemblies, learn associated specialties, learn to understand advanced methods of utilizing combat equipment, and acquire experience in executing combat missions in the most complex conditions of air and ground situations.

(A caption photograph by I. RYBIN on page 28 shows Lt A. SKRIPKA, technician of a radar station, helping subordinates prepare for an examination.)

Mastery and Confidence--by Capt V. V. STULOVSKIY (pages 31-35)

Abstract:

Extols the professional skill of Maj Aleksey Sergeyevich USHAKOV, GCI Controller 1st Class. USHAKOV has more than 2,500 successful intercept guidances to his credit and is considered the best controller in his chast'.

An Outstanding Flight--by Lt Col S. F. KHLYSTOV (pages 32-33)

Abstract:

Praises Maj FILONOVICH, Pilot 1st Class and commander of an outstanding flight. Maj FILONOVICH was awarded the Order of the Red Star for success in mastering aviation equipment and in training and educating subordinates.

Youth Gains Experience (page 35)

Abstract:

Reports that at the end of the past academic year recent graduates of a pilot school arrived in the squadron commanded by Maj NEVZOROV. The young pilots were aided in their study of combat equipment and its methods

of employment by experienced pilots Maj NEVZOROV, Capt PODKORYTOV, Capt OGAREV, and Capt RYZHOV.

Stimulate Officer-Candidate Training in Every Way Possible--by Col A. I. MOTYL'KOV (pages 36-38)

Abstract:

Discusses the educational processes used in military educational institutions, pointing out the shortcomings of the generally accepted lecture method and the effectiveness of the independent study method. Independent studies in the educational process are superior to lectures because it involves the active participation of all students according to their capabilities.

On Teaching Automation in Schools, a letter to the editors by Engr-Lt Col I. A. GARBUZOV (page 38)

Abstract:

Maintains that automation should remain one of the basic courses in secondary military schools and should include some of the subjects which were taught last year in the electrical engineering course.

Orientation of Podrazdeleniye Installations -- By Lt Col B. Ya. PERELYGIN and Engr-Capt P. F. ZVERYAYEV (Pages 39 - 42)

Text:

As is known, when equipment is set up at a new position, the installations of an air defense rocket podrazdeleniye must be oriented. Experience shows that some officers are inaccurate in executing this operation, in particular, in determining required azimuth corrections for a launcher. This is because they have a superficial knowledge of the essence and peculiarities of orientation. Thus, we will consider the order and possible methods of orientation.

During orientation, certain difficulties are met with in determining the corrective settings $\Delta\beta p$ and $\Delta\beta pu$ by known formulas in manuals. The problem is that the optical telescope mounted on the cabin is displaced in relation to its rotation axis by $\Delta\ell p$ and the panorama on the launcher is displaced in relation to its turning axis by $\Delta\ell pu$. This displacement makes it necessary to determine the angular corrections $\Delta\beta p$ and $\Delta\beta pu$ and to introduce them in the directional azimuths to landmarks when determining azimuths for orienting an installation by landmarks.

There are formulas for determining the indicated corrections, but they are difficult to use in practice since the distances to the landmarks must be known to solve them. These distances are determined in practice either by actual measurement or by methods of topographic tying. Either method requires a great expenditure of time and effort.

It should also be taken into account that usually no landmarks are visible in the panorama from the place where the launchers are. Therefore, artificial landmarks must be used. Then, the known formulas cannot be used since the landmarks are in such close proximity to the launcher. Officers in our podrazdeleniya do not use landmarks for orienting installations. They orient a cabin and a launcher by backsighting along an aiming circle which is oriented beforehand on a true azimuth to any landmark. It is not necessary to determine and introduce a correction with this method since this is automatically taken into account in the orientation.

We will consider this by example. Let us suppose that an aiming circle, set up at the orienting point (or-p) at point C, is oriented on any landmark with the true azimuth of the landmark from the orienting point (β or) being known (figure 1). Suppose that the optical telescope is located exactly on the cabin rotation center (point A, position I) and directed at the aiming circle which is aligned on this telescope. Actually, it will be located at point B and its optical axis BD will be parallel to AC. Then the true directional azimuth from the cabin to the aiming circle will be equal to $\beta p1$.

By rotating the cabin, we align the effective optical telescope with the aiming circle and the aiming circle with the optical telescope. Then, the telescope has the position B_1 and its optical axis is directed along B_1C. The hypothetical optical telescope is turned to angle $\Delta\beta p$ and has the position II (point A). Its optical axis will be aligned with AC_1 since AC_1 will be parallel to B_1C and $\beta p_2 = \beta p1 + \Delta\beta p$.

Since the optical telescope is displaced in relation to the center of cabin rotation, the directional azimuth to the landmark (the aiming circle) should be increased to angle βp for its orientation. However, this angle need not be determined since, as mentioned earlier, the true azimuth for orientation of the cabin together with correction of angle $\Delta\beta p$ can be obtained with the aiming circle. It is evident from the figure that AC_1 is parallel to B_1C and the angle B_1CA is equal to angle C_1AC, i. e., equal to $\Delta\beta p$.

Therefore, $\beta b_2 = \beta b1 + \Delta\beta p$ and the true azimuth of the bearing from the aiming circle to the optical telescope of the cabin automatically includes the value $\Delta\beta p$.

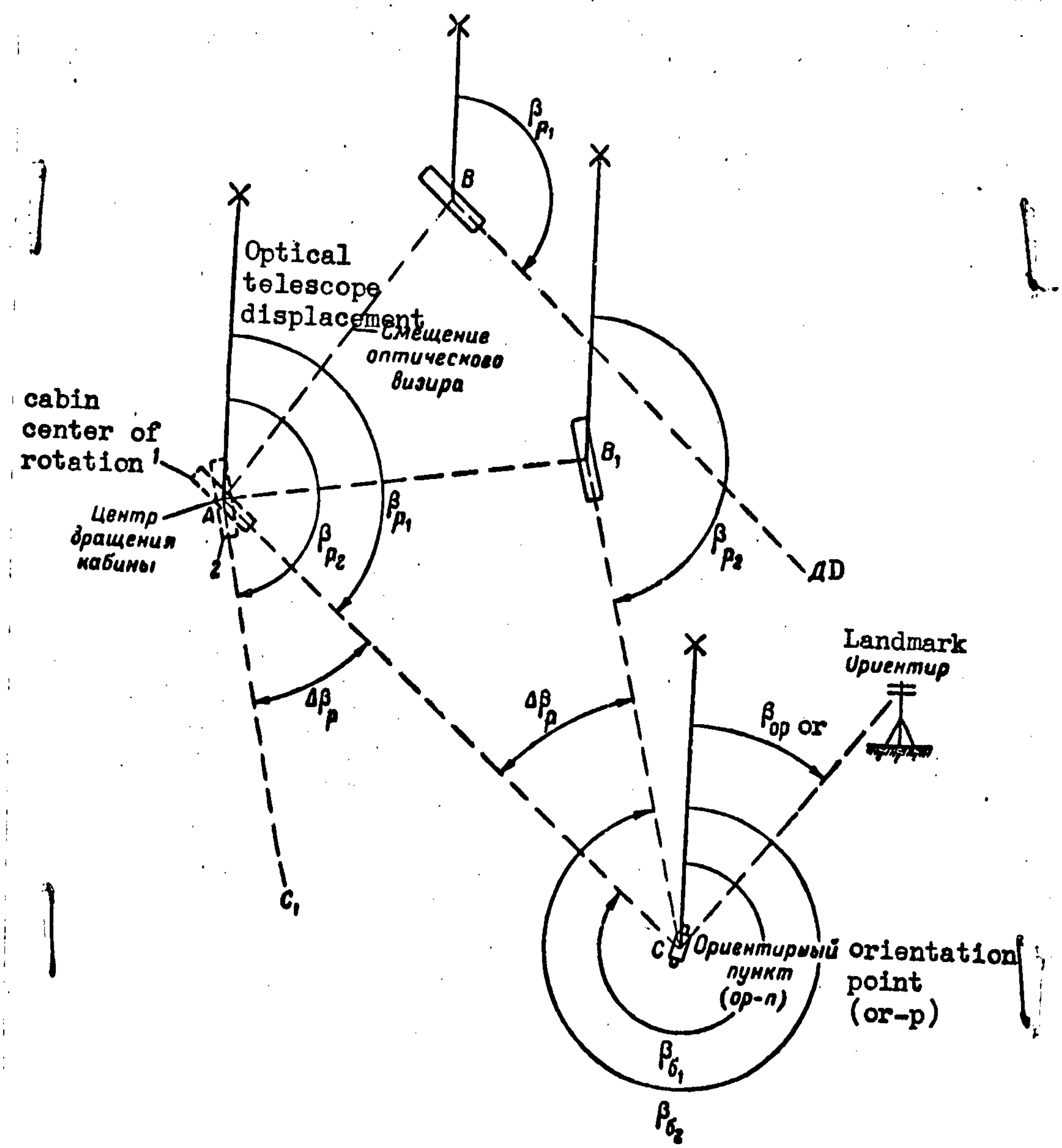

Figure 1.

Calculation of Δβpu can not be avoided when a launcher is oriented and the orientation angle reading is set on the panorama by backsighting along a previously oriented aiming circle because, in contrast to the cabin, this directional azimuth reading to a landmark is determined not on the azimuth scales, but on the launcher panorama. However, experience has shown that the calculation of Δβpu by known formulas can be dispensed with here. We will explain the process of orienting a launcher in more detail.

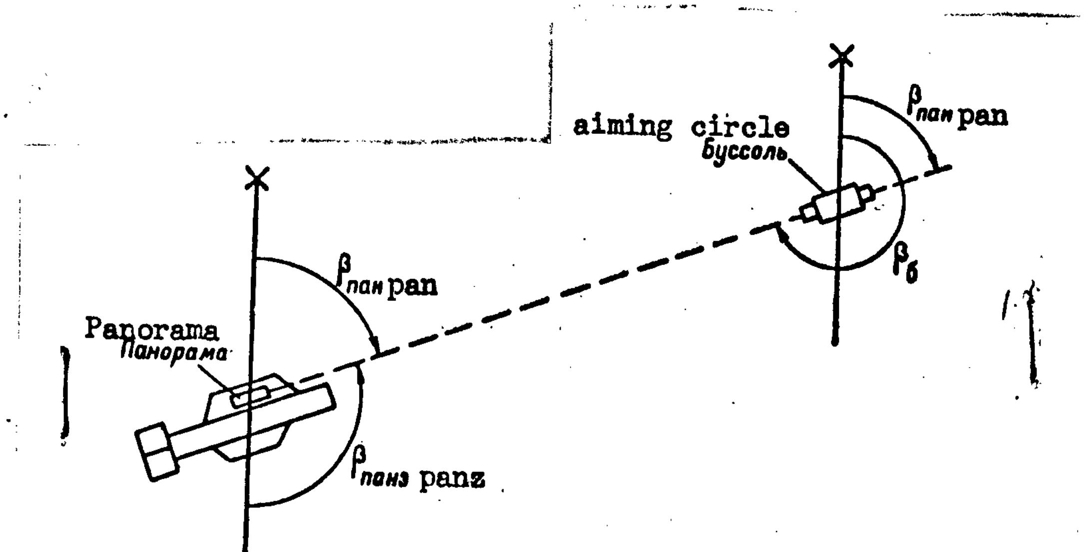

Рис. 2.

Figure 2.

The position of a launcher with a panorama reading of 30-00 aligned with an oriented aiming circle is shown in figure 2. βb is the true directional azimuth from the aiming circle to the panorama. Suppose that it is equal to 40-20. It is also evident from the figure that βpan differs from βb by 30-00. Consequently, βpan = βb 40-20 ± 30-00 = 10-20.

However, it is not possible to establish this angle on the panorama to orient the launcher since the derived angle of 10-20 is the azimuth, i. e., the angle counted off in a clockwise direction from the north bearing of the true meridian. The azimuth ring of the panorama used to orient the launcher is read in a counter-clockwise direction. Also, the panorama reading is 30-00 when the optical axis of the panorama and the launcher beam are aligned to the north. So the reading 0-00 corresponds to the south heading.

Thus, an angle counted off in a counter-clockwise direction from the south heading of the true meridian must be used to orient the launcher with the panorama. This angle is called the zenithal true azimuth. It is designated βpanz in figure 2. It is evident from the figure that βpan + βpanz = 30-00. In our example, βpanz = 30-00 - 10-20 = 19-80.

It sometimes happens in practice that βpan is larger than 30-00. So βpanz = 90-00 - βpan. This azimuth value is established on the panorama when orienting the launcher.

The value of βpanz can be obtained without using the formulas mentioned earlier. The following method is used for this. First, the aiming circle is set up at the orientation point. Then, the reading 0-00

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is set on the azimuth ring and drum. With the aiming circle in this position, the reading of 0-00 is also set on the deflection ring and drum. Then, the aiming circle is directed at the launcher panorama which, with a reading of 30-00 is directed at the aiming circle by turning the launcher. The reading on the deflection ring and drum is the value of βpanz (figure 3).

However, this method, like the method for deduction of βpan and βpanz does not eliminate the need to introduce the correction of Δβpu into the obtained βpanz. Officers NIKITIN and IVANOV have suggested a

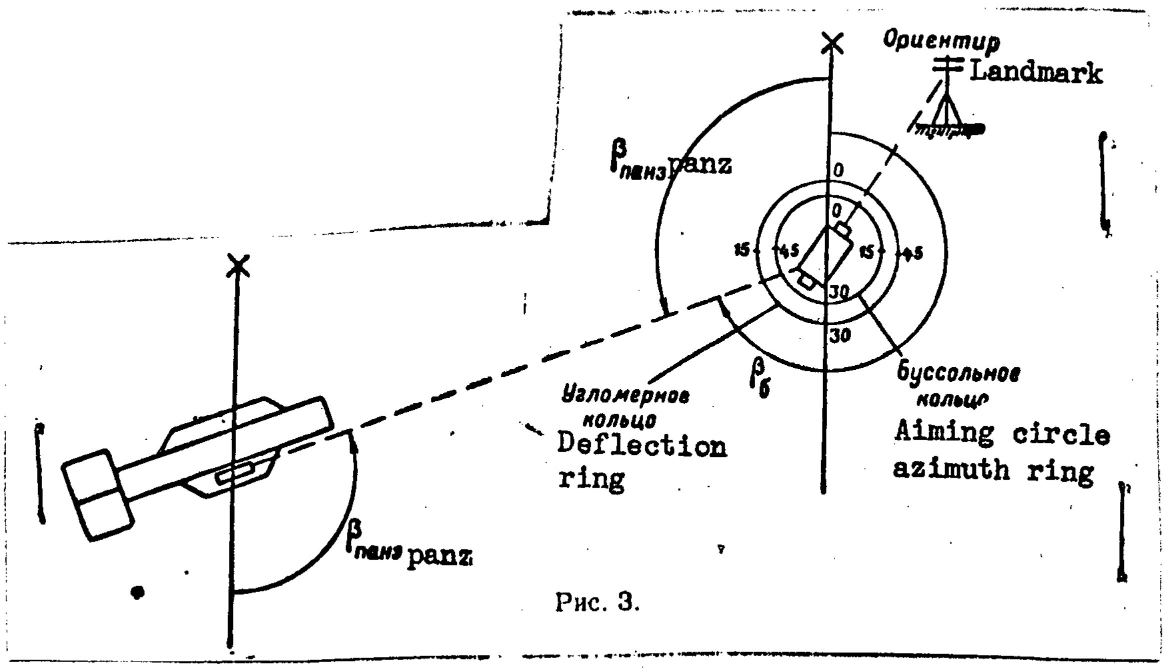

Figure 3.

method for introducing the correction of Δβpu into βpanz without any computation. This is done by carrying out sequential changes of the size of βpanz and executing the following operations: The aiming circle is set up at the orientation point and oriented. The zero positions on the azimuth and deflection rings are made to coincide. The aiming circle is directed toward the panorama. Then, the launcher indicators are aligned with the cabin scales and the reading of 30-00 is set on the panorama. The panorama is directed at the aiming circle by rotating the launcher. Then, the reading of βpanz is read from the deflection ring and established on the panorama which takes position I. This discontinues backsighting between the panorama and the aiming circle. Backsighting is established again by rotating the launcher. Then, the launcher is in position II and the panorama is in position III. Now, the reading of βpanz must be taken from the deflection ring and set on the panorama which takes position IV. This breaks backsighting between the panorama and the aiming circle.

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Backsighting is again established between the panorama and the aiming circle by rotating the aiming circle and the launcher. Now, the launcher takes position III and the panorama takes position V. The reading of βpanz must be taken from the aiming circle deflection ring by repeating the previous operations and established on the panorama which is again turned to take a new position. Backsighting is again established between the launcher and the aiming circle by rotating them. The launcher is in position IV and is directed to the north along the true meridian, i. e., it is oriented.

Thus, by sequentially changing the angle βpanz to the size of Δβpu, the launcher can be oriented without calculation of Δβpu.

It is evident that the method just described requires much time and that errors are easily made while carrying it out. Therefore, one of our officers suggested a new method for orienting launchers. It consists essentially of the following. The launcher panorama is set at 30-00. Then, the launcher is activated, its indicators are coordinated with the cabin data transmitters, and the launcher data indicator scales are synchronized with the cabin data transmitter scales. The scales of the azimuth data indicator should read 0-00. Then, the launcher is rotated so that the vertical cross hair of the panorama is on the landmark or on the aiming circle if it is being used for the orientation. Tha launcher positioning unit is stopped by pressing the "stop" button. Then, the true azimuth value reading from the panorama to the landmark (aiming circle), i. e., βpu, must be established on the instrument scales by turning the azimuth indicator unit manually and then the "Start" button of this block is pressed. The launcher is then oriented.

This last method greatly simplifies orientation, saves time, and decreases chances for errors in the orientation process.

(A captioned photograph by I. RYBIN on page 42 shows Capt V. MAL'TSEV, podrazdeleniye commander, training subordinates in the execution of preventive maintenance.)

The Influence of the Earth on the Formation of a Radar Radiation Pattern-- by Engr-Capt V. I. IGNAT'YEV (Pages 43 - 46)

Text:

Full exploitation of the tactical and technical capabilities of radar is determined to a significant degree by the location of the station. The local topography of a radar position has much influence on the maximum range, on the altitude measurement capability, and on the precision of target coordinate determination of a radar. It [the

[redacted]

topography] can cause great distortion of a radar radiation pattern, which in turn causes certain difficulties in determining target coordinates at various altitudes. This is why the allowable surface dimensions suitable for radar scanning, the size of closing angles in a distant area, and the altitude of obstacles in the position region must be known when choosing a position to set up a scanning radar. These factors must be considered by taking into account the nature and character of ultrashort radiowave propagation. 50X1

It is known that radiowaves have electromagnetic similarities to light waves. When they strike a dielectric surface, one part is reflected and the other part is refracted to penetrate the dielectric where it is absorbed. If radiowaves strike the surface of an ideal conductor, they are completely reflected. The earth has the qualities of a dielectric for the ultrashort waves of radar.

The reflection of radiowaves is explained by the development of highfrequency currents on the surface of the earth under the influence of the striking radiowave energy. The individual currents develop a secondary radiation, i. e., a reflected wave with its energy dependent upon the conductance of the ground and the size of objects in the path of the radiowave propagation. Radiowaves are best reflected from surfaces which have large conductance, for example damp ground, ground with grass and foliage, or the ocean. Rocky and sandy ground does not reflect radiowaves well. It should also be considered that reflection can be specular or scattered (diffused) depending on the type and size of obstacles (slopes, depressions, ravines, elevations) in the path of the radiowave propagation.

Specular reflection is observed with smooth surfaces. Its angle is equal to the angle of incidence in these conditions. Since the radiowave is reflected in only one direction, the wave will have a significant amplitude. An uneven surface causes the reflected waves to be scattered. Then the reflection angle is not equal to the angle of incidence and the radiowaves are reflected in various directions.

Since the earth reflects radiowaves, it has much influence on the operation of those radars which have wide radiation patterns in a horizontal plane. With such patterns, part of the antenna radiated radiowaves always strikes the earth in the vicinity of the radar and is unavoidably reflected from it. The presence of reflecting surfaces near a radar causes the energy of the main pulses to go to the target as two radiowaves -- directly from the station (direct) and after reflection from the earth (reflected). In the same way, radiowave energy reflected from a target goes to the radar antenna both directly and by being reflected from the surface of the earth.

The well known method of specular reflections, where waves reflect from the earth change their phase of oscillation 180° in antennas with horizontal polarization, is used in considering the reciprocal action of direct and reflected waves.

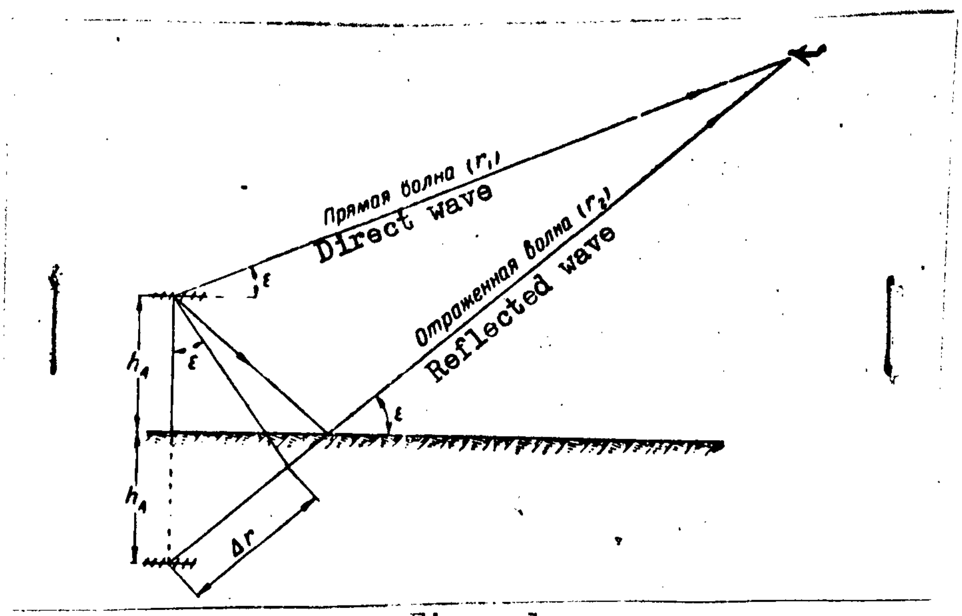


Figure 1.

It is evident from figure 1 that direct and reflected waves travel different distances to the target: the first is r_1 and the second is:

$$r_2 = r_1 + \Delta r.$$

Since the target is a significant distance from the radar antenna, it can be considered that the beams r_1 and r_2 are practically parallel. The total intensity of the field at the target is the result of the addition of the direct and reflected wave fields. Its magnitude depends on their amplitudes and the phase relationship. Since the reflected wave travels a greater distance to the target than the direct wave, it will strike the target with a certain difference in phase which is determined by the difference in wave travel Δr which depends on the target angle of elevation (ϵ) and the height of the radar antenna (h_a) from the earth:

$$r = 2h_a \sin \epsilon . \qquad (1)$$

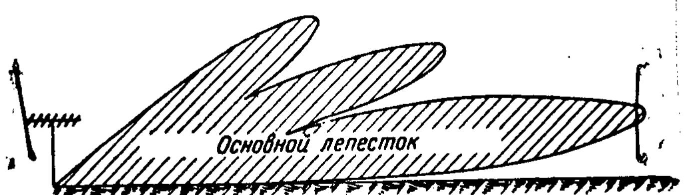
Thus, the intensity of the radiation field in the space over the surface of the earth will be changed from a m inimum (almost zero) to approximately double the amount of the radiation field of a direct wave. The amount of change depends on the difference in travel between the direct and reflected waves. The directions in which the waves coincide in phase are the <u>bearings of radiation maximums</u>. Here, the direct and reflected waves are added together to increase the total field intensit 50X1 so that the radar detection range is significantly increased.

The directions in which the waves are in antiphase when they strike the target, i. e., they subtract from each other, are called bearings of radiation minimums. Here, the field intensity is weakened and the radar detection range is correspondingly decreased.

Radiation maximums and minimums cause the development of lobed radiation patterns in a vertical plane. One lobe near the earth is the major lobe (figure 2). It should be remembered that the number of lobes depends on the antenna height and the wavelength as shown by the formula for their determination:

$$\frac{h_a}{\frac{\lambda}{2}}.$$

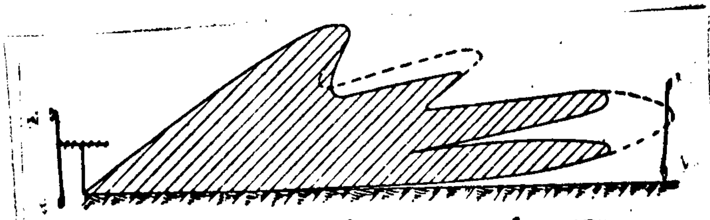
Therefore, the greater the antenna height in comparison to the wavelength, the more lobes there will be in the pattern.



Major lobe

Рис. 2.

Figure 2.



------ Оптимальная диаграмма направленности
——— Диаграмма с провалами

------ Optimum radiation pattern
——— Pattern with troughs

Figure 3.

It is evident that to receive a maximum radar detection range, the best earth-reflected radiowave must be used -- the specular reflection. Thus it is desirable to locate the radar on an even surface with damp soil and without obstructions.

If the radar position is on rough terrain, the radiowaves reflected from the earth will be scattered. Then, a very weak reflected wave is received, the lobe aspects are changed, distortion appears in the radiation pattern, and troughs appear in the major lobe. All of this leads to a decrease in the radar detection range (figure 3).

It should be remembered that individual sections of the earth do not play identical roles in the formation of radiation patterns. Therefore, the section of the surface of the earth which is involved in the reflection of the radiowaves of a station is divided into zones called Fresnel zones. These zones are elliptical rings arranged at various distances around a reflection point. The centers of the ellipses do not usually coincide either with the reflection point (C) or with each other (figure 4). The area of the first Fresnel zone is the zone of effective earth reflection where the formation of an electromagnetic field of the reflected waves chiefly occurs. Knowledge of the dimensions

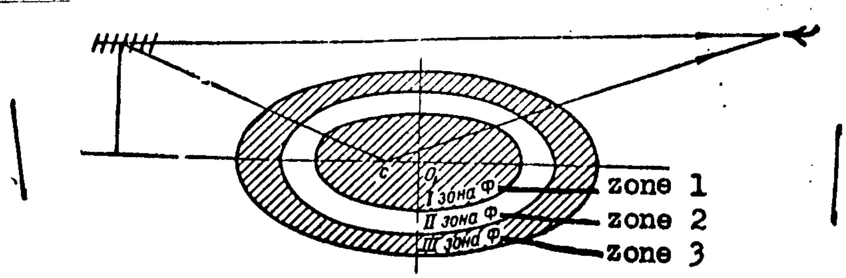


Рис. 4.
Figure 4.

and location of the first zone has great practical value since this allows the size of this area to be determined which is necessary to align the area to achieve an optimum radiation pattern. Such an area can be called the station near zone. The distribution of this zone in respect to a radar antenna is shown in figure 5. It is evident from the figure that the dimensions of the first Fresnel zone for a given radar depend on the target angle of elevation: the greater the angle of elevation, the larger the zone, i. e., the larger the zone ellipse. The designations on the figure indicate:

x_0 - distance from the antenna to the center of the ellipse (of the first Fresnel zone;

ϵ - target angle;

a - major semiaxis of the ellipse;

R_{min} - distance from the antenna to the near boundary of the reflection zone;

R_{max} - distance to the far boundary of the reflection zone.'

For long range radar detection and tracking, it is important that targets be detected timely at long range, i. e., the work should be done at small angles of elevation within the major lobe of the radiation pattern.

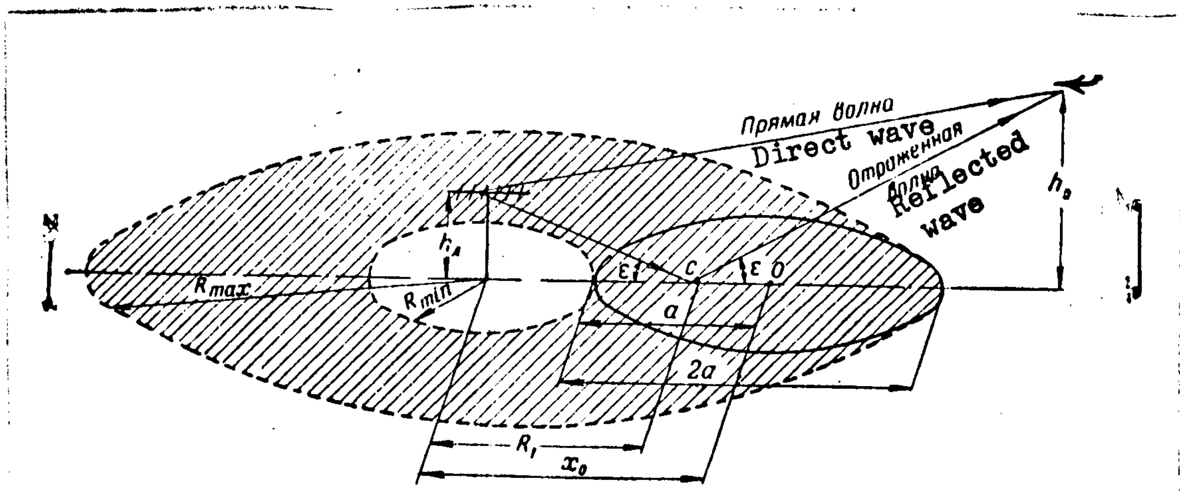


Figure 5.

The angle in the vertical plane corresponding to the direction of the major lobe maximum is then the angle of elevation necessary for the most expediant determination of the dimensions of the first Fresnel zone. The given angle can be determined from the formula:

$$\sin \epsilon_{max} = \frac{\lambda}{4h_a}. \qquad (2)$$

We see from figure 5 that the boundaries of the position near zone are determined by the formula:

$$R_{min} = x_o - a \text{ and } R_{max} = x_o + a. \qquad (3)$$

If values for x_o and a are substituted in the formula, rather simple relationships for the radii confining the position near zone are derived:

$$R_{max} \cong 23.3 \frac{ha^2}{\lambda} \text{ and } R_{min} \cong 0.7 \frac{ha^2}{\lambda} .$$

Analysis of the derived relationships which determine the position near zone dimensions indicates that the dimensions of the near zone depend on the wavelength, the antenna height, and the target angle of elevation. The immediate area around the antenna within the radius of R_{min} has no substantial importance in the formation of the antenna radiation pattern.

To achieve a specular reflection from a position inside the area bounded by R_{min} and R_{max}, all factors causing the electromagnetic energy to be scattered and absorbed should be excluded. However, if the roughness of the earth does not exceed a determined amount, it will not show up in the radiowave reflection. The allowable height of irregularities depends on the wavelengths and their angle of incidence. The reflection will be specular if the height of irregularities in the reflection zone is significantly less than the wavelength. From this condition, the height of an allowable irregularity (hi) can be equated:

$$h_i = \frac{\lambda}{16 \sin \epsilon} \text{ (M).} \qquad (4)$$

It is evident from the relationship that the allowable height of irregularities changes for various distances from a station. Radiowaves strike steeply close to a radar antenna (angle is large). Therefore, only small irregularities are permissible here. However, the farther the reflection point from the antenna, the smaller the radiowave angle of incidence and the greater the size of allowable irregularities. To determine h_i in practice for various distances from a radar antenna, it is convenient to use the following formula of approximation:

$$h_i \cong \frac{\lambda}{16 h_a} d \text{ (M),} \qquad (5)$$

where d is the distance from the radar to the irregularity.

It should be noted that since this is a formula of approximation, the value of allowable irregularities is slightly high in calculations for small angles of elevation, i. e., for large d.

To eliminate distortions in the formation of a radiation pattern, there should be no power and telephone lines, high reinforced concrete and brick buildings, structures with iron roofs, iron poles, etc. in the position near zone. The presence of such objects in the position leads to shielding of the electromagnetic energy radiated by the radar. Behind such objects are formed zones which are not swept by radiowaves and are called "dead". Since they do not help to form radiation patterns, troughs are formed in the radar detection zone.

Large irregularities and indigenous objects in the near zone also influence radar operation. They cause reflected signals which are received with the reflections from aerial targets. These signals complicate aerial target detection since a pulse from a target will be observed on a scope on their background. It is also necessary to consider the phenomenon of diffraction which causes radiowaves diffracted by indigenous objects to be held close to the earth. This leads to errors in determining the angles of elevation of targets.

In selecting a position to set up a radar scanning station, the first guides to be followed are the requirements inherent in the radar station itself. Besides the general requirements in the station log, the closing angle in a distant zone which should not exceed an established value to eliminate shielding of the radar electromagnetic energy should also be considered. There should be no sharp terrain slope at the position since this leads to distortion of the detection zone in the vertical plane and to a significant reduction in radar range for high-altitude targets. The elevation of the terrain should also be strictly observed since it leads to elevating the detection zone in the vertical plane, which in turn leads to a decrease in radar range for targets at low and medium altitudes.

The most expedient position for radar scanning is one near a water surface or one with a small closing angle. Then the influence of interference from local objects located beyond the closing angle is eliminated and high precision in measuring angles of elevation of low flying targets is maintained.

The antennas of radars with small cone angles have sharp radiation patterns. Thus the radiation pattern is formed without substantial earth influence. Therefore, the basic criterion for elaluating a position for such a radar is consideration of the closing angle. The most preferable position for this type of radar is one which has zero or negative closing angles. Positive closing angles should be selected so that there are no blind areas, i. e., "dead" zones, in the radar detection zone. To decrease closing angles from nearby local objects, the radar is set up on a natural or constructed elevation.

Thus, the selection of a radar position is very important in the formation of a station antenna radiation pattern and consequently for maximum use of the tactical and technical capabilities of a radar.

EQUIPMENT AND ITS USE

Maintaining Communication Facilities in Constant Combat Readiness -- by Lt Gen Sig Trps L. I. GAVRILENKO, (pages 47-50)

Excerpts:

On the basis of the latest achievements of Soviet science and technology, PVO Signal Troops are today equipped with facilities which possess high operational reliability and are capable of providing steady and uninterrupted communication at great distances and in any conditions. However, no matter how perfect these facilities may be, they cannot be effectively utilized and kept in constant combat readiness without correctly organized technical support and exemplary upkeep and maintenance.

To provide constant good working conditions and high combat readiness of communication facilities, precise planning of maintenance and repair work is very imoortant. With this end in view, a yearly plan for technical support of communication facilities is being developed in each podrazdeleniye. This plan is the basic guiding document regulating the use of communication facilities, a more rational expenditure of present resources, the timely replacement of equipment, the organization of equipment servicing, and the conduct of equipment inspections and repair work. In content and form this should be thorough and detailed. Specific tasks on technical support for each complex of equipment for the entire year are outlined in it. The plan is confirmed by the chief engineer or the deputy commander for technical affairs.

It should be noted that the content and form of the plan now in use by the troops, is not yet perfect. Its shortcoming is that it does not give comprehensive descriptions of communication facilities existing in the podrazdeleniye, and their operational capabilities. To avoid this, columns should be included in the plan with instructions on the number of hours allotted to combat work and the number of hours worked since the beginning of an operation and after the end of the last repair. It would also be expedient to indicate in the plan all the measures for technical support of communication facilities, including equipment inspections, checks, repairs, regulating work, and the periods when conducted. In compliance with this, the plan should be named The Plan for Technical Support for Communications....

Technical servicing includes a whole series of measures. Inspection and checks are a part of this, and so is weekly, monthly, quarterly, and yearly maintenance work. All persons concerned with the operation of communication facilities participate in these measures. However, the major role in this work belongs to commanders and engineers of podrazdeleniya, to deputy commanders for technical affairs, and to chief engineers....

Not all commanders have achieved observance of the requirements set forth for the installation and upkeep of antenna and mast installations. In particular, serious violations of instructions are committed in the preliminary treating of wood masts and feeder supports, the prevention of corrosion of metal parts of riggings, the upkeep and mainteneance of insulators and also the completion of contact connections of feeder lines, downleads and lead-ins... Some commanders try to justify shortcomings in the organization of preventive maintenance in antenna and mast installations by the absence of specialists sufficiently trained in this field. But who will train the specialists if not the commanders themselves?

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Serious shortcomings are also found in technical servicing of storage batteries....

One of the important conditions ensuring high-quality equipment servicing of communication facilities and maintaining them in good working order is systematic and multiphase checking.... A special place in the general system of checking should be given to equipment inspection. It includes an external inspection for serviceability, the presence and condition of all component parts, the condition and correctness of technical documents, and storage conditions for apparatus and other equipment....

PVO Signal Troops have the full potential for making the technical support of communication facilities fully meet modern requirements. The task of commanders, political workers, and party and Komsomol organizations consists in attaining further improvement in the technical knowledge of personnel and improvements in the technical servicing of communication facilities. This will make it possible to eliminate apparatus malfunctions, prevent conditions leading to operational failures, and increase the combat readiness of the entire communications system of our troops.

Reliable Aid to Pilots -- by Capt V. P. CHEKHOMOV (Page 50)

Abstract:

Commends Tech-Sr Lt SHEVCHENKO, an outstanding technician who attains a high number of flying hours for his aircraft each year without failures of components. SHEVCHENKO was awarded the Medal for Combat Services. A sketch of SHEVCHENKO is included with the article.

The Support Team for Maintenance in a Podrazdeleniye -- Engr-Lt Col Yu. P. GALKIN and Lt Col Tech Serv O. A. TOROPOV (Pages 51-53)

Abstract:

Discusses the duties, equipment, and work of support teams for podrazdeleniye equipment maintenance, primarily in radar podrazdeleniya. Their duties include: aiding podrazdeleniye personnel in repairing equipment, helping station crews to organize and execute equipment operation inspections, training personnel in skills for the determination and correction of malfunctions in equipment, analyzing and publicizing skills in equipment usage, and developing new methods and means for equipment repair. These teams perform their functions either according to preventive maintenance schedules or upon requests from podrazdeleniya for equipment repairs or according to the level of technical training of personnel. Their equipment is similar to that of a field repair shop.

(A captioned photograph by K. FEDULOV of Tech-Sr Lt N. OBRAZTSOV, an aircraft maintenance specialist, appears on page 53.)

Men of High Duty -- by I. P. LYSYY, Photographs by I. N. SAVIN (Pages 54-58)

Abstract:

Praises the professional proficiency of maintenance unit personnel with specific examples of work performed by the officers and men of an interceptor maintenance outfit.

A captioned photograph on page 55 shows Capt Tech Serv Ye. UL'YANOV and Sgt A. SAVEL'YEV, mechanic, checking a piece of aviation equipment.

A captioned photograph on page 56 shows Capt Tech Serv N. SHAMAYEV checking the work performed by M/Sgt A. KUTEROV, a specialist 1st class who usually receives outstanding ratings.

A captioned photograph on page 57 shows Sgt A. SEREDIN, specialist 1st class, working on an engine. SEREDIN, a highly qualified aviation mechanic, is a master of his speciality.

Methods for Performing Radar Maintenance -- by Engr-Col I. M. TSEBRO (Pages 59 - 62)

Abstract:

Discusses procedures for planning and performing daily, weekly, monthly, and yearly servicing and maintenance of radar equipment and explains responsibilities of officers in organizing, supervising, and evaluating equipment maintenance.

(A captioned photograph by I. N. NIKOLAYEV on pages 60 - 61 shows M/Sgt Aleksandr ISACHENKO, specialist 1st class and commander of a motor vehicle platoon, talking with Pvt I. MIGUNOV. MIGUNOV is shown leaning out of the cab of a possible 4x2 light truck and the tail assembly of a possible MIG 17 is shown in the background.)

Teaching Machines and Their Use (Pages 63-71)

Text:

An article, "Programed Training with Special Machines," by T. I. ROSTUNOV was published in the 1963 No 2 issue of Herald of Antiaircraft Defense. This article, discussing the production and use of teaching machines, evoked a most vivid interest among military officers. Referring to it, many readers have informed us of constructive research in designing and producing special teaching machines in chasti and educational institutions. Some teaching machines which have been made by innovators are discussed below.

The OM-4 Machine -- by Engr-Cols and Candidates of Technical Sciences K. S. LABETS and M. L. KHAVIN, Engr-Lt Col E. A. BERNSHTEYN, Engr-Capt and Candidate of Technical Sciences N. K. RUDYACHENKO, and Engr-Capt G. N. BOYKO (Pages 63-67)

Text:

The OM-4 teaching machine constructed in our school is designed for independent work and self-checking of acquired study material and for checking the knowledge of trainees. Training material is subjected to preliminary processing when using the OM-4, i. e., so-called program cards are prepared with the inclusion of certain questions. The trainee is given two or three answers for each question and he must select the one or two answers which are correct. The answer selected must be fed into the machine.

The character and complexity of the questions are determined in the training process by the type of trainees and their assignments. The questions are presented in a logical sequence with gradually increasing complexity. For example, when studying a subject such as "Pulse Modulators with Ion Commutators," several program cards can be prepared. Following is a sample card:

Discharge Circuit Elements. Artificial Line.

1. In what line elements is energy accumulated?
a) in capacitors, b) in inductance coils.

2. How is the duration of a formed pulse affected, if:
the inductance of cells L_c is increased?
a) it is decreased, b) it is increased, c) it is not changed.
the capacitance of cells C_c is increased?
a) it is decreased, b) it is increased, c) it is not changed.
the number of cells n_c is decreased?
a) it is increased, b) it is decreased, c) it is not changed.

3. How is the duration of a formed wavefront affected, if:
the number of cells n_c is increased?
a) it is increased, b) it is decreased, c) it is not changed.
the cell inductance and capicitance are decreased?
a) it is increased, b) it is decreased, c) it is not changed.

LITERATURE: Neyman, M. S., Course in Radiotransmission equipment, Part II, Chapters IV - V. "Soviet Radio."

An external view of the OM-4 is shown in figure 1. Located on its front panel are: a power supply toggle switch (1), "start" and "stop" buttons (2), bulbs which indicate answered questions (3), toggle switches a, b, and c which conform to respective answers (4), a window to show either of two inscriptions: "Correct, continue" and "Find the second answer" (5), and a button and four bulbs to flash an evaluation "5", "4", "3", or "2" (6).

There is a program panel with 36 two-position toggle switches numbered from 1 to 72 for program selection under the hinged upper cover. This is also the location of a toggle switch for turning off the "stop" button and for locking the power supply switch, of a toggle switch for switching "error weight", and of bulbs to illuminate the number of an incorrectly answered question.

A line diagram of an OM-4 is shown in figure 2. It includes: two step-by-step switches - ShI-25/8 (1 Sh) and ShI-50/4 (2 Sh), three RS-13 relays (R_1, R_2, R_3), 20v X 0.15 amp bulbs and 20 MTKh tubes, and 42 two-position switches (T).

A 26v X 0.8 amp rectifier (L) on a VS-45-46 selenium stack is included in the circuit to power the step-by-step switche windings, the relays, and the tubes. A 100v X 0.05 amp rectifier (11) on a D7Zh is included to power the MTKh-90.

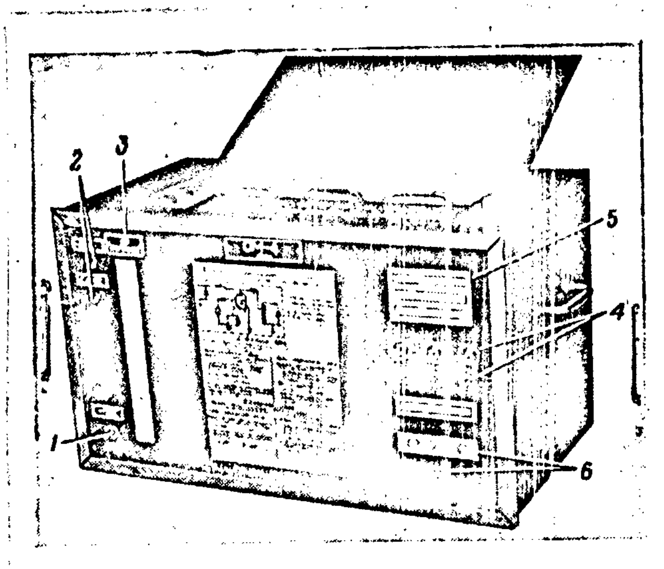

Figure I.

In the circuit, switches T_1 - T_3 are for the first question, T_4 - T_6 are for the second question, etc. There are two correct answers "a" and "b" contacts are closed: T_1 - (1 - 3), T_2 - (1 - 3 and 4 - 2), and T_3 - (4 - 6) which corresponds to the numbers 1, 25, and 50 on the upper panel. The step-by-step switches are in the zero position since, as shown in the circuit, it is only here that the end switch 1 Sh is open.

A program for the machine is composed in accordance with a table. The table is used to program only the answers "a" and "b". The answer "c" is automatically programed by the teaching machine.'

Using the given table, all the answers are enumerated as numbers selected with the two-position switches. Here is an example of the answer enumeration to the questions on the included example program card: 1, 4, 6, 8, 12, 26, 27, 29, 31, 33, 35, 49, 51, 53, 55, 57, and 59.

Operation on the machine is begun by pressing the "start" button. When the question number (1) is illuminated, the machine is ready for operation. The trainee answers the first question by flipping the answer switch "a", "b", or "c". If the answer is correct, the inscription, "Correct, continue," is shown and when the answer switch is moved back, the next question number is shown. If the answer is incorrect, the inscription, "Incorrect, consider," is shown and when the switch is moved back, the number of the next question is not illuminated. The machine does not allow the next question to be answered until the correct answer is given for the previous question.

In those cases when there are two correct answers, after the return of the selected answer switch, the inscription, "Find the second answer," is shown and only after it is found can the next question be answered.

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All errors in answering are registered by the "error lights." For example, when questions "2" and "3" are incorrectly answered, the second and third bulbs are illuminated and they stay illuminated until the "stop" button is pushed.

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Question Number	Answer Choice	Program Switch Position Number			
		Correct	Incorrect	One Correct Answer	Two Correct Answers
1	a b	1 25	2 26	49	50
2	a b	3 27	4 28	51	52
3	a b	5 29	6 30	53	54
4	a b	7 31	8 32	55	56
5	a b	9 33	10 34	57	58
6	a b	11 35	12 36	59	60
7	a b	13 37	14 38	61	62
8	a b	15 39	16 40	63	64
9	a b	17 41	18 42	65	66
10	a b	19 43	20 44	67	68
11	a b	21 45	22 46	69	70
12	a b	23 47	24 48	71	72

When the work is completed, an evaluation of the number of mistakes is shown. The "error weight" switch is moved to receive an answer evaluation depending upon the number of questions per card (6 and 12).

Two operation modes are provided in the machine: "Self-training" (self-checking) and "Examination" (question, check). Switching to operation modes is done with switch T_{38} (figure 2). When the machine is in the "Self-training" mode, the trainee has complete control of the machine (start, stop, intorduction of answers, reception of a running evaluation), but when the machine is in the "Examination" mode he cannot use the "stop" or "evaluation" buttons.

The circuit begins to operate the moment the "start" button is pushed. When the "start" button is pushed, the winding of the step-by-step switch 1 Sh is energized. When the button is released, the step-by-step switches 1 Sh and 2 Sh are in the first position. Suppose that the answer "a" switch is closed in response to the first question. The current goes from the 26v rectifier over the circuit: "a"- 1 Sh pass 1 - 1 Sh_1^1 - T_1 - R_1 - chassis. The contacts 1/1 of relay R_1 are closed, the lamp burns, and the inscription, "correct, continue," is illuminated. Then contacts 2/1 are closed, the 1 Sh winding is energized, and the armature is turned so that the step-by-step switch is readied to go to the contacts 1 Sh_2^1, 1 Sh_2^2 ...etc. The designation 1 Sh_2^1 means the first step-by-step switch, the second contact, first row.

After the switch "a" is released, the winding of relay R_1 is de-energized, the lamp burns which illuminates the inscription, "Correct, continue," the 1 Sh winding is de-energized so that its moveable contacts go to the next position, and contacts 1 Sh pass 4 - 1 Sh_2^4, 1 Sh pass 5 - 1 Sh_2^5, 1 Sh pass 1 - 1 Sh_2^1 are closed.

If the question is programed for one correct answer, voltage is supplied from the 26v rectifier to the 1 Sh winding along the circuit; T_3 toggle switch contacts, 1 Sh_2^4. Simultaneously, the 1 Sh contact breaker de-energizes the winding of the step-by-step switch and its moveable contacts, without stopping, go to the next position to contacts: 1 $Sh^5{}_3$, 1 $Sh^4{}_3$, 1 Sh_3^3, 1 Sh_3^2, 1 Sh_3^1, 1 Sh_3^6, 1 Sh_3^7, 1 Sh_3^8.

This switching causes the second question ("2") lamp to be lit and the program switches T_4 and T_5 for the given question are switched in to the answer toggle switches "a", "b", and "c" through the contacts: 1 Sh_3^1 - 1 Sh pass 1, 1 Sh_3^2 - 1 Sh pass 2, and 1 Sh_3^3 - 1 Sh pass 3.

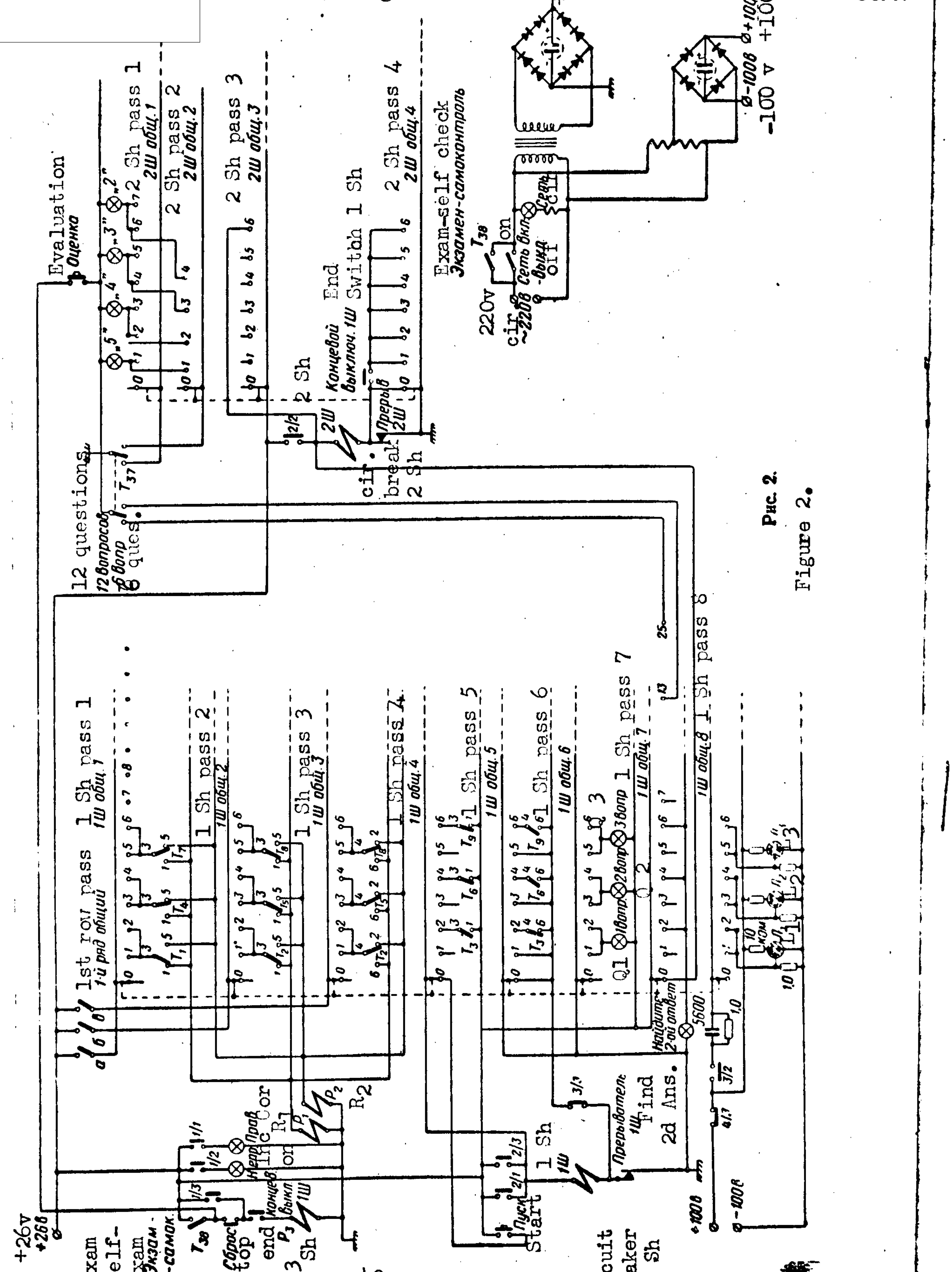

Рис. 2

Figure 2.

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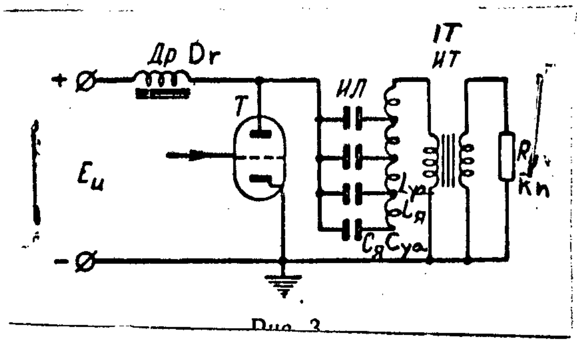

Figure 3.

If a question has two correct answers as shown in figure 3 for question "1", the program switch T_3 is put in the proper position to break the power supply circuit of the 1 Sh winding and to short-circuit its circuit breaker.

Then when the first correct answer for the given question "1" is fed into the machine, the 1 Sh moveable contacts remain on the "2" contacts. The first question lamp continues to burn and the answer toggle switches "a", "b", and "c" remain connected to the T_1 and T_2 program toggle switches through the contacts: 1 Sh pass 1 - 1 Sh_2^1, 1 Sh pass 2 - 1 Sh_2^2, and 1 Sh pass 3 - 1 Sh_2^3. The contacts 1 Sh pass 7 - 1 Sh_2^7 are closed and the lamp illuminating the inscription, "Find the second answer," is illuminated.

When the toggle switch for the incorrect answer is switch in, for example toggle switch "c", the R_2 relay winding is energized and the lamp showing the inscription, "Incorrect, consider," is illuminated. Simultaneously, the contacts 2/2 are closed and the 2 Sh step-by-step switch winding is energized. When the "c" toggle switch is switched off, the 2 Sh moveable contacts switch to the second position ("2" stationary contacts), and 2 Sh is closed since its circuit breaker is a closed circuit: the contacts of the end switch 1 Sh and also 2 Sh_1^3, 2 Sh pass 3 are closed.

When the "Evaluation" button is pushed, the evaluation lamp is lit. The evaluation is determined by the position of the moveable contacts of the step-by-step switch 2 Sh.

To change the "evaluation weight" depending on the number of questions per card from 6 to 12, the first or second row of the step-by-step switch is connected through 2 Sh pass 1 or 2 Sh pass 2 to the chassis by the T_{37} switch.

The registering of wrong answers is accomplished by the lamps which are switched by the moveable contact 1 Sh pass 8 through contacts 1 Sh_1^8, 1 Sh_2^8,...etc. and contact 3/2 of relay R_2.

An advantage of the OM-4 machine is that it can be used for studying various disciplines and subjects. Also, it is simply contructed, easy to use, and highly reliable. It requires less than 40 watts of power. The use of this machine allows checking and self-checking to be accomplished 2 to 3 times more rapidly then with ordinary methods and enables errors made by trainees to be objectively represented.

The OMCh-1 Machine -- by Engr-Maj M. Kh. CHASHNIKOV (Pages 67 - 70)

Text:

It is known that much electric power and equipment is expended in training personnel to operate equipment. It is difficult to be certain whether personnel have correctly executed operations if the training is done on "cold" equipment. This matter is complicated by a shortage of visual aids and a limitation of time available for practical training in military schools [VUZ[. As a result, trainees cannot acquire solid practical skills in equipment operation during planned training activities.

To overcome these limitations and difficulties, our innovators have developed the OMCh-1 teaching machine. With it, theoretical material can be studied and practical work habits can be acquired in a chast' or podrazdeleniye. By coupling the machine to "cold" equipment for training, soldiers and sergeants can check their work in completing operations. This saves both equipment and electricity.

The OMCh-1 machine can be especially effective if it is mounted in a cabinet with front panels and instead of the toggle switches on the machine the toggles switches on front panels are used. Then training and development of functional responsibilities can be done directly on models of equipment.

Experience shows that when it is not possible to work directly on "cold" equipment, the equipment can be replaced by block circuits and drawings or photographs of front panels. Then the trainee by working on the machine can check function correctness and acquire necessary practical skills.

The OMCh-1 can be used in a rocket podrazdeleniye to work out the order for switching in apparatuses, the functional responsibilities of crew members in combat work, the order for carrying out functional checks and for servicing equipment, the rules for using check and measurement equipment, etc.

The OMCh-1 machine is constructed in a duralumin case. All control and signal equipment is located on the front panel. An external view of the OMCh-1 in working position is shown in figure 1. The electric circuitry (figure 2) consists of the following circuits: program card performance, knowledge evaluation, and power supply.

The program card performance circuit includes: relays P_1 - P_{16}, toggle switches T_1 - T_{14}, tubes LN-7 and LN-8, button switch KN-2, resistor R_{19}, and capacitor C_1.

The given circuit (figure 2) operates as follows: Relay P_1 begins to operate when T_1 is switched on, and relay P_2 begins to operate after the operation of P_1 by switching on toggle switch T_2, etc. Thus, a sequence for operation execution is bound into the order for switching in relays P_1 - P_{14}. If the trainee executes the operations correctly, relay P_{14} begins to operate at the end of the cycle and the "Correct" bulb is illuminated through its normally open contacts.

If the operations sequence is broken, for example, T_9 is switched on immediately after T_1, P_9 will not operate, P_{16} is switched in and self-blocked through its normally open contacts, and the "Incorrect" bulb is illuminated.

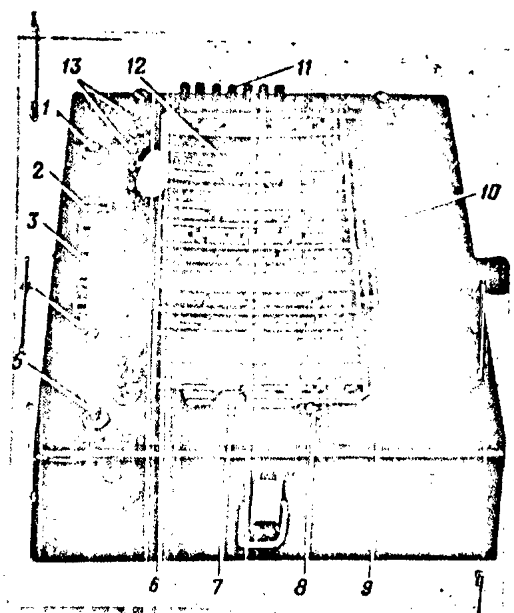

Figure 1. External View of the OMCh-1: 1 - "Initial position" button; 2 - "Failure" window; 3 - window with evaluation registration; 4 - "Evaluation" button; 5 - "Stop" button; 6 - "Incorrect" bulb; 7 - "Correct" bulb; 8 - toggle switch for turning on machine; 9 - signal lamp; 10 - plug sockets; 11 - sockets; 12 - program card; 13 - toggle switches.

To return the incorrectly switched toggle switch to its initial position, the "Stop" button must be pressed (KN-2). Relay P_{16} is de-energized and the "Incorrect" bulb goes out.

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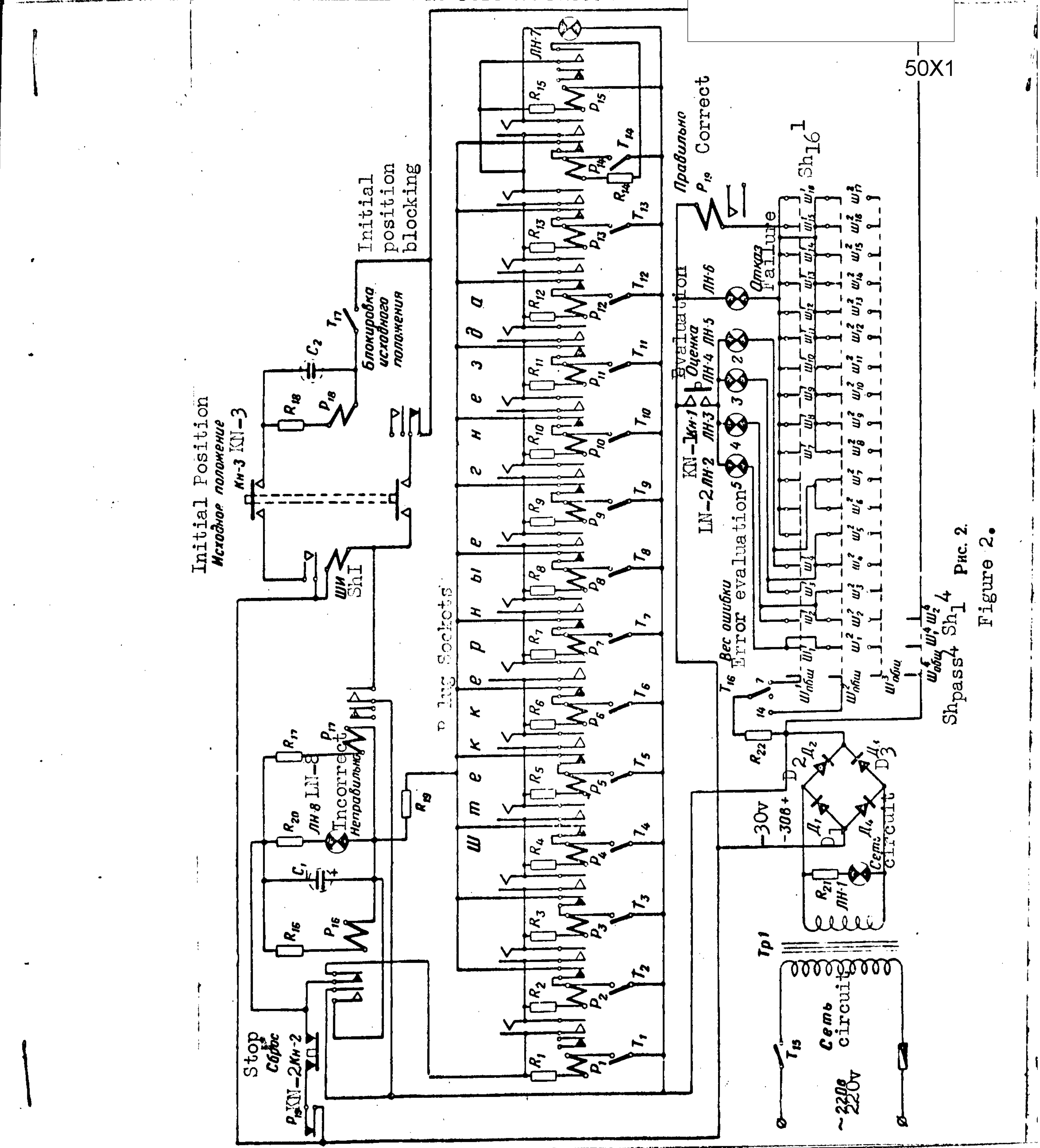

Рис. 2.
Figure 2.

S-E-C-R-E-T

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Resistor R_{19} and capacitor C_1 increase the operation time of P_{16} and P_{17}. This is done so that they do not begin to operate when relays are correctly switched in opening the normally closed contacts through which P_{16} and P_{17} supply a current pulse.

If there are fewer than 14 operations per program card, the plugs and their sockets are used to exclude unnecessary relays. Normally open relay contacts not used in the given operation are thus closed to make possible operation of subsequent relays.

Relay P_{15} exclused closing P_{14} throughthe "Correct" bulb if it is not used in the given card program. Its normally opened contacts are closed by a plug. Then, if the trainee completes all operations correctly, the "Correct" bulb is illuminated.

The knowledge evaluation circuit (figure 2) consists of: the step-by-step switch (Sh1) for relays P_{17}, P_{18}, and P_{19}, tubes LN-2 - LN-6, toggles switches T_{16} and T_{17}, and button switches KN-1 and KN-3.

If the trainee commits a mistake in the operation process, P_{17} begins to operate simultaneously with P_{16}. Through its normally open contacts, the step-by-step switch registers the error. P_{17} and the step-by-step winding are de-energized by pressing the "Stop" button.

When the "Correct" bulb is illuminated, the "Evaluation" button must be pressed which causes a grade 5, 4, 3 or 2 to appear in the window i.e., the trainee's work is evaluated.

The "error weight" can be changed in the OMCh-1 depending on the number of operations per program card by the toggle switch T_{16} which has a step-by-step switch conforming charge supplied through its contacts. If a card has up to 7 operations indicated, the first charge is recorded by placing the toggle switch in the "7" position; if there are 14, a second charge is recorded by placing the toggle switch in the "14" position.

If the trainee does not know the material at all and attempts to find an answer by trail and error, P_{19} operates. Its normally open contacts de-energizes the whole circuit and the "Failure" window is illuminated, i.e., the machine "fails" to train an unprepared trainee. T_{16} must be placed in the middle position to switch out the failure circuit.

Relay P_{18} is used to return the step-by-step switch to its initial position after each operation cycle is completed. The "Initial Position" button and capacitor C_2 are involved in this.

Toggle switch T_{17} blocks the "Initial position" button. It is used to check trainee operation during the complete cycle.

In the OMCh-1 are used: 19 RSM-2 relays, the step-by-step switch ShI-17, a 30v X 1.5 amp transformer, 4 D-304 diodes, 16 double-pole toggle switches, one triple-pole toggle switch, 2 30mfd X 50v capacitors, 21 MLT 0.5 110 $\pm$ 10% ohm resistors, one 39 ohm resitor R_{19}, and other parts.

Study material is introduced into the machine by program cards which have strict sequence for program completion. Each point is inscribed on a card in the order of the front panel toggle switches used for switching on relays. These toggle switches are arranged in conformance with a code used in the machine and encoded as follows: 4, 9, 14, 5, 10, 1, 6, 11, 2, 7, 12, 3, 8, 13, i.e., T_1 is in the fourth place from the top, toggle switch T_2 is in the ninth position, etc.' This is done so that the trainee does not switch in relays mechanically, but observes a logical sequence for executing operations.

The program card is placed on the front panel in such a way that the operation inscribed on it is opposite a corresponding toggle switch.

If the program card contains fewer than 14 operations, any of the relays can be short-circuited. This makes operation of the machine flexible. If the program contains 10 operations, relays P_1, P_3, P_5, and P_7 will be excluded in the first card. Then it will have the following sequence for switching on toggle switches: 9, 5, 1, 11, 2, 7, 12, 3, 8, and 13. Relays P_6, P_8, P_{10}, and P_{12} must be excluded for the second card producing a sequence for switching on toggle switches of: 4, 9, 14, 5, 10, 6, 2, 12, 8, and 13.

It is evident from these examples that the sequence for switching in relays is sharply changed. Consequently, mechanical memorization of the order for switching on toggle switches is avoded with the use of program cards.

Training with the OMCh-1 is done in the following manner. Before work is begun, all toggle switches are placed in the left position and the machine is plugged into a 220v power source. To turn on the machine, the "Voltage" switch is moved to the right position. This illuminates the "Voltage" bulb. Then a program card is placed onthe front panel. Plugs are inserted into the sockets which are opposite empty columns. Then all operations on the program must be completed in sequence.

This machine is used in our chast' to train radar operators in the order of executing individual operations in working with equipment.

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The "Interrogation and Training" Machine -- by Maj Sh. G. KHOD (Pages 70 - 71)

Text:

Innovators of our chast' with the help of Sr Lt PETROV, a student at the Kiev Higher Radiotechnical Engineering School of PVO Strany Troops (KVIRTU), have constructed a very simple "Interrogation and Training" teaching machine to be used in training radar operators. The machine is built into a box with the machine controls and signaling devices located on two inclined panels. The machine responds by signal to correctly or incorrectly completed operations by a trainee. The trainee's operation consists of a sequential switching on of a row of toggle switches which conform to program card inscriptions.

The machine has two operation modes: "Interrogation" and "Training." In the "Interrogation" mode, it responds to trainee operations as follows: It gives the signal, "Correct," when an operation is fully completed in a correct sequence and it flashes the signal, "Incorrectly," if an operation is done incorrectly and incompletely.

In the "Training" mode, the machine "prompts" a trainee in completing an operation by means of sequentially illuminated bulbs located alongside of toggle switches, i.e., the operator can individually study how to carry out any operation stipulated by a program card.

With the machine, personnel can study: the order for switching on various types of radards, how to check radar operation, how to tune radars, how to adjust equipment when acting as duty officer, how to check defects in components and blocks, the sequence for crew member operation in carrying out maintenance work, and other questions connected with the use of contemporary radar.

A line diagram of the machine is presented in figure 1. Its electrical unit is an RSM-2 relay circuit. Relay P_1 is connected directly to the power supply through the toggle switch T_1. Current flows to the windings of subsequent relays through the normally open contacts of previous relays. When P_{12} is switched on, the "Correct" signal bulb is lit. Thus, power is not supplied to a next relay with non-sequential relay operation and the "Correct" signal bulb is not lit.

The "Machine Ready" signal bulb which signals that the relays are ready for operation is connected in parallel to the P_1 winding.

The "Incorrect" signal bulb is connected in parallel to the winding of the incorrect answer relay P_{13}. The leads of this bulb are connected directly to the power supply and to the supply switches through the normally closed contacts of a sequential r-c circuit.

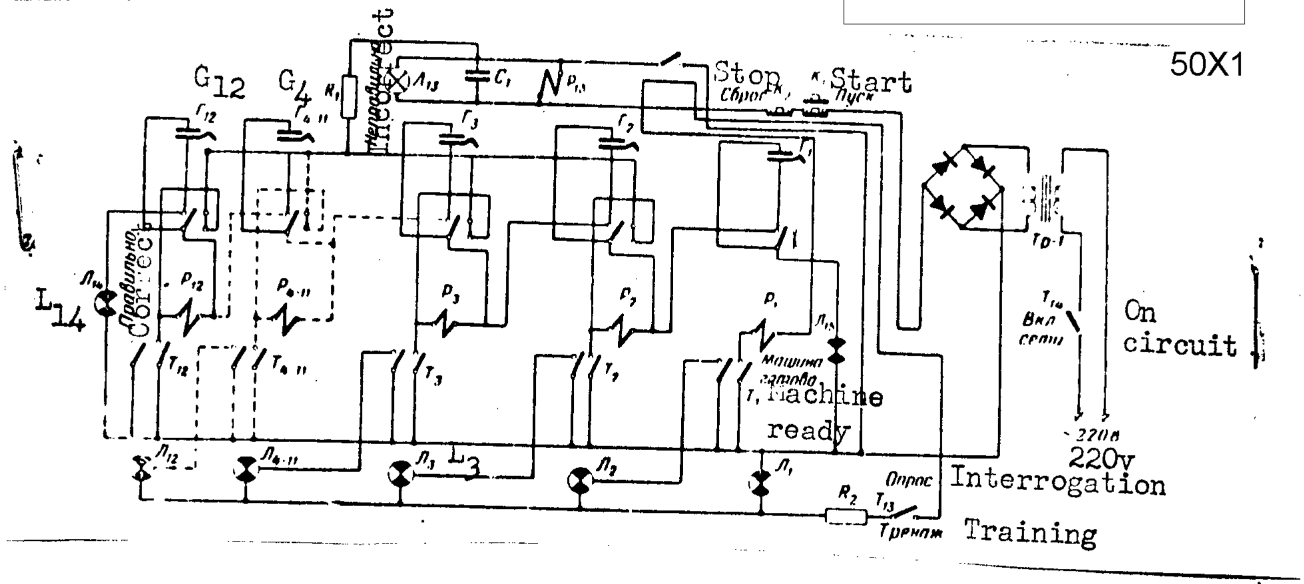

Figure 1.

These normally closed contacts are opened when toggle switch T_1 of the first relay and then T_2 of the second relay are switched on so that voltage is supplied to P_{13} as a pulse of short duration. The duration of this pulse is determined by the operation time of P_2. Thanks to the r-c circuit (r = 100 ohms, c = 50 pf) which is connected to P_{13}, this relay does not operate.

When switching is done incorrectly, for example if after T_1, T_{10} is switched on, P_{10} does not operate. Voltage will be supplied through its normally closed contacts to P_{13} which turns on the "Incorrect" signal bulb. P_{13} is self-blocking with open contacts and with its contacts open it opens the power supply circuit. This is necessary to avoid the correct answer signal bulb being lit if the 12 toggle switches are switched on in an improper sequence. Consequently, to light up the "Correct" signal bulb, all 12 toggle switches must be switched on in a logical sequence.

The machine is transferred from the first to the second mode by supplying voltage through the "Interrogation - Training" toggle switch to the signal bulbs by the algorithm toggle switches. Alongside of each of these switches is a connected signal bulb. The toggle switches are arranged haphazardly to avoid the trainee switching on relays by mechanical observation of a sequence and so that he will switch them on on the basis of logical data: 12, 2, 4, 7, 9, 3, 10, 1, 6, 8, 5, and 11. If the algorithm has fewer than 12 operations, the "extra" relays are excluded by closing their normally open contacts with plugs. There is a special socket box on the control panel for this.

Training on the machine is done as follows: A composed algorithm is inscribed on a program card. Its separate points are arranged in the same sequence as are the toggle switches.

On cards with fewer than 12 operations, there are notes indicating relay contacts to be short-circuited during operation of the machine. 50X1

The prepared card is placed on the front panel of the machine so that the operations inscribed on it are opposite corresponding toggle switches on the machine. When the power is turned on and the "Start" button is pressed, the "Machine Ready" signal bulb is lit. Then, an operation mode is selected depending upon the training goal.

Then, the trainee, if working in the "Interrogation" mode, switches on the toggle switches for algorithms in a logical sequence. If he is working in the "Training"mode, he switches them on in accordance with signal bulb indications. If the sequence is not broken and the operation is completed, the "Correct" signal is given. If the sequence is broken, the incorrect answer bulb is lit. If this happens, the incorrectly switched on toggle switch must be returned to its initial position and the "Stop" button pressed. When the "Machine Ready" bulb is lit, the operation can be continued.

If in the "interrogation" or "Training" mode the trainee receives the "Correct" signal, he must push the "Start" button. Then the "Machine Ready" light goes out. After this, the algorithm toggle switches are returned to their initial positions.

Widespread usage of similar and more perfected teaching machines can significantly raise the level of technical knowledge and practical skill of personnel.

ROCKET DEFENSE

The Interception of Ballistic Rockets -- by Ya. I. PETROV (Pages 72 - 76)

(Based on foreign press materials)

Text:

Much attention is being paid in foreign countries, especially in the US, to questions concerning how to combat long range ballistic missiles and also medium range missiles which can be launched from submarines. US specialists claim that the basic means for combatting ballistic missiles in the next ten years should be a system using an anti-missle missile to intercept and destroy ICBM [MBR] warheads. The Nike Zeus system is at present the missile defense [PRO] system of the US.[1] It is designed to detect and discriminate ICBM warheads in groups of dummy targets and then to destroy the warheads during the terminal phase of their flight. It is proposed that antimissile missile batteries of this system be set up to defent important administrative and industrial centers and military installations, especially ICBM bases.

Foreign specialists believe that if this system initially detects targets at a range of 1600 km and the antimissile missile has a speed of 3 km/sec, all operations for the interception of a target with an average speed of 8 km/sec must be completed in less than 3 minutes. Then a target can be destroyed at an altitude sufficient to avoid exploding the combat charge so low that the defended territory is damaged.

The interception of an ICBM warhead is shown in figure 1. How is an interception carried out according to this figure? When a foreward target acquistion radar [RLS] obtains a fix on an object which might be a missile warhead, a signal is sent to a detection system computer. The antimissile missile battery is brought to readiness No. 1. The interception system computer begins operation and the warhead identification radar is switched in. It processes data for each detected object. These data are supplied to the detection system where they are compared to standard indices of a memory unit which have been obtained by special research for determining the characteristics of warhead flight. If an ICBM warhead is detected among the objects as a result of the comparison, the interception system computer switches in the target tracking radar, determines how many antimissile missiles are needed for the interception, and switches on an automatic system to prepare these antimissile missiles for launch. Gyroscopes are started and power supply sources are switched on.

Further data from the target tracking radar is supplied to the interception system computer which computes the warhead trajectory, the initial antimissile missile trajectory, and the point where the warhead is to be detonated. Conforming data is supplied to the guidance radar of each individual antimissile missile. Data concerning the warhead trajectory and the antimissile missile flight program is constantly made more precise and corrections are introduced into the system right up to the instant when the antimissile missile enters the interception region.

When the antimissile missile has reached an assigned speed, altitude, etc., the device for detonating the combat charge is readied.

After the interception system computer gives the signal for combat charge detonation, all mechanisms of the memory unit are returned to their original condition and the system is ready to intercept new targets.

The interceptor system is fully automated. However, if it is necessary, manual control can be used. During the interception, an operator mans an indicator which produces a three-dimensional portrayal. This indicator is located at the antimissle missile battery control station. This station also has an installation for checking the system automatically. This installation is used to check all of ground electronic equipment including the interception system computer and the onboard guidance equipment of the antimissile missile.

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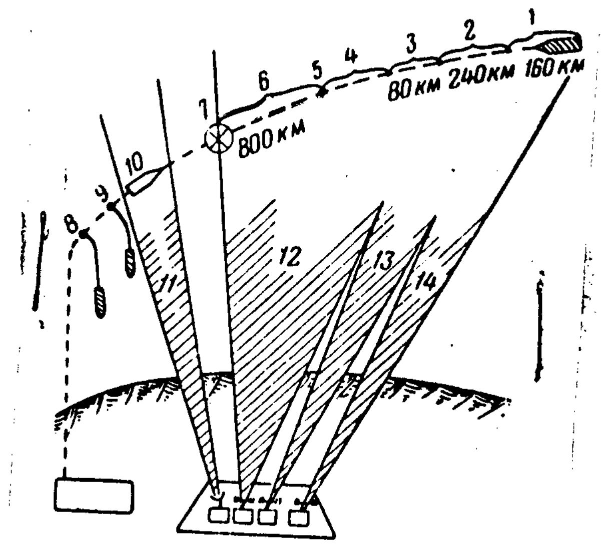

Рис. 1.

Fig. 1: 1 - target detection (the warhead goes 160 km in 20 seconds); 2 - warhead identification from dunny targets (the warhead goes 240 km in 30 seconds); 3 - determination of target trajectory (the warhead goes 80 km in 10 seconds); 4 - antimissile missile preparation for launch; 5 - command for antimissile missile launch; 6 - antimissile missile entrance in target region the warhead goes 800 km in 100 seconds); 7 - interception point; 8 - antimissile missile flight to first stage separation; 9 - antimissile missile flight to second stage separation; 10 - antimissile missile warhead flight to meet target; 11 - antimissile missile guidance radar; 12 - target tracking radar; 13 - target identification radar; 14 - forward target detection radar.

The interception of an ICBM on the terminal phase of its trajectory is illustrated in figure 2 which also shows the relation between the interceptor speed and the speed and range of tartet detection with a given radius of a protected zone. It is evident from the illustration that only a minimum amount of time can be expended after receiving the interception command in order to launch the antimissile missile to the necessary point. However, the characteristics of modern engines and power supplies and also the comparatively long time required to start gyroscopes cause the performance of this assignment to be very difficult.

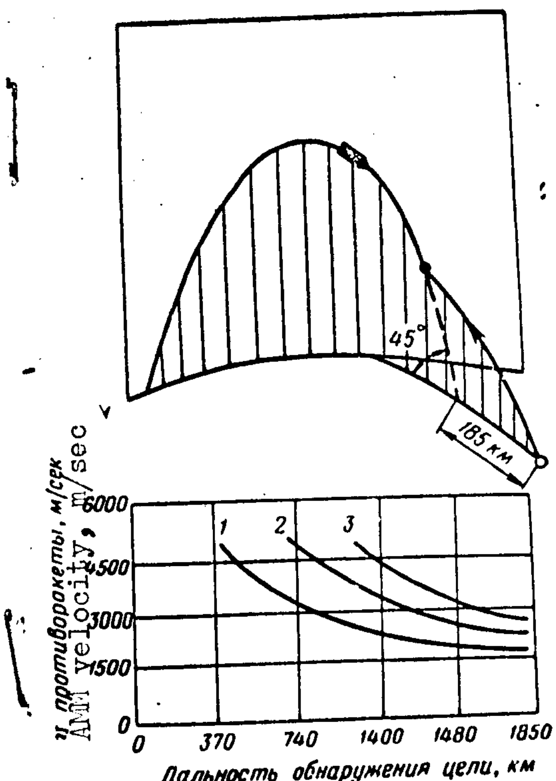

Fig. 2. ICBM interception on the terminal phase of its trajectory showing the relation between the antimissile missile speed and the speed and range of target detection (the target impact angle is 45°, the radius of the protected zone is 185 km): 1 - target speed is 6,000 m/sec; 2 - target speed is 9,000 m/sec; 3 - target speed is 12,000 m/sec.

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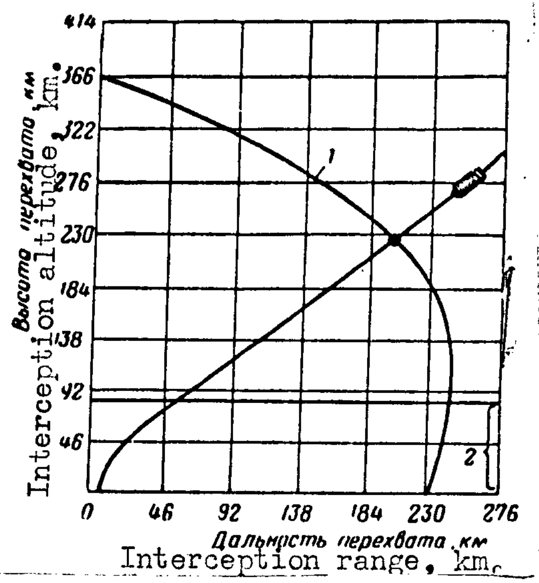

Fig. 3. Standard conditions for terminal phase interception (target impact angle is 45^0, target speed is 9,000 m/sec): 1 - maximum interception perimeter; 2 - effective atmosphere (approximate).

A graph characterizing standard condtions for terminal phase interception is presented in figure 3. As is evident from the graph, a target can be intercepted either within the limits of the effective atmosphere or beyond it. In the first case, the interceptor can maneuver by means of aerodynamic controls. In the second case, some sort of gas dynmaic control is necessary, i.e., the warhead should have a reactive power source.

To carry out interceptions within the limits of the effective atmosphere, the constructional design of the antimissile missile must satisfy rigid strength and aerodynamic requirements to provide controllability with very large changes of pressure head. Gas dynamic controls can be used in addition to aerodynamic controls to increase maneuverability. It is also necessary to provide heat shielding for the interceptor under these conditions.

Not only can an ICBM be destroyed while it is in the terminal phase of its trajectory, mid-course phase interceptions can also be made. At first glance, this type of interception seems advantageous since target may be destroyed while it is still a great distance from the defended objective and in some cases the interception can preceed the discharge of dummy targets. However, problems of antimissile missile guidance and dummy target discrimination if the dummy targets have been dispensed from the ICBM are so complex that mid-course phase interception of an ICBM cannot be considered reliable. Therefore, foreign specialists consider this type of interception as only auxiliary. The communication speed to the antimissile missile for mid-course phase interception of a target, in the region of the tarjectory apex for instance, is determined by the target acquisition time, the precision of target tracking while the ICBM is in the boots phase of its flight, and the location of the antimissile missile launch sites.

The relation between the communication speed to the antimissile missile and the time of missile launch and the location of the launch sites is shown in figure 4. It is evident from the figure that a comparitively small increase in the speed of the ICBM can nullify all of the advantages of a forward launch position and a mid-course phase interception. In this case, if the ICBM apogee height is increased, the speed necessary for the antimissile missile is sharply increased. Also, the forward antimissile missile launch position is less effective when the ICBM can be launched from different directions which again emphasizes the difficulty of mid-course phase interception.

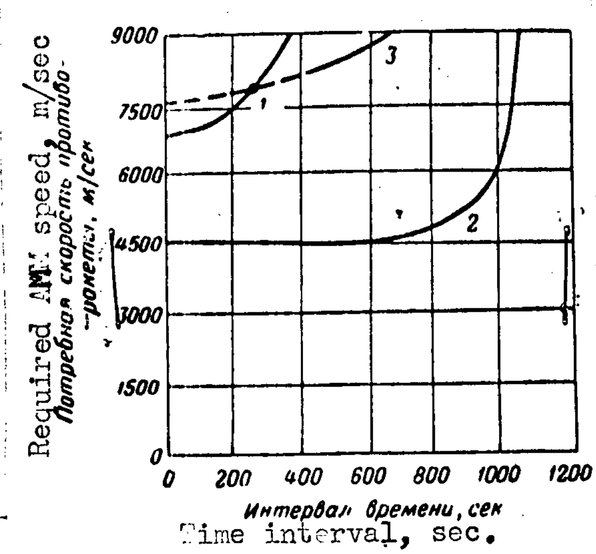

Fig. 4. The relation between communication speed to the antimissile missile and the time of missile launch and the location of the launch sites: 1 - antimissile missile position in the defended zone; 2 - antimissile missile position under the apogee of a normal ICBM trajectory; 3 - antimissile missile position under the apogee when the altitude is increased to 5,500 km.

It is also possible to destroy the target during the boost phase of its trajectory. This type of interception can be accomplished in two ways: destroying the warhead or damaging the rocket system. The

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antimissile missile must carry a powerful combat charge for the first method, but for the second method the antimissile missible can have a fragmentation type warhead with ordinary explosives [VV] since even minor damage to the rocket system causes the ICBM to be deflected from its assigned trajectory. The general requirements for the antimissile missile in this case remain the same as those for mid-course phase interception except for speed which must be increased. Also, the antimissile missile launch position must be located on the territorial perimeter of the probable enemy.

It should be noted that an ICBM during the boost phase of its flight trajectory is a target which gives off intensive heat radiation. For this reason, intensive work is being carried on in the US to develop an ICBM interception capability based on the detection of thermal radiation by infra-red detectors placed on artificial Earth satellites and on destroying in ICBM interceptors launched from satellites.

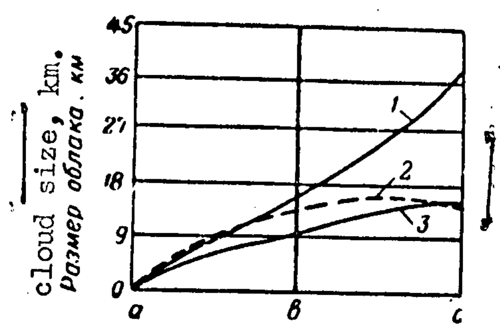

Fig. 5. Dummy target "cloud" expanse depending upon the location and direction of the discharge of dummy targets in relation to the ICBM trajectory: a - termination of boost phase; b - apogee; c - terminal phase of flight. 1 - dummy targets dispensed in the plane of the trajectory in the direction of its major axis; 2 - dummy targets dispensed perpendicular to the plane of the trajectory; 3 - dummy targets dispensed in the plane of the trajectory in the direction of its minor axis.

One of the most difficult problems of ICBM interception is the discrimination of warheads from dummy targets which can form an extensive "cloud" (figure 5). In the mid-course phase of the ICBM, light objects such as metallic ribbons can be used as dummy targets and in the terminal phase, heavier objects are employed. These heavier objects may be shaped like arrows, cones, wheels, etc. They may even be fuel tank fragments. Any objects having ballistic parameters similar to warheads can be employed.

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Discrimination of targets can be accomplished by determining their weights, shapes, and dimensions since a warhead when compared to dummy targets has larger size and weight and a more proportional shape. The dynamic characteristics of a body when it enters the atmosphere, its radiation or reflection properties, and the effect of its surrounding medium can serve as distinctive characteristics for target discrimination.

The dynamic characteristics upon entering the atmosphere can be determined by the character of the change in the speed of a body in relation to its altitude. For example, a warhead being large and heavy and having a small drag coefficient begins to lose speed at a comparatively low altitude, but metallic ribbons lose their speed of descent when they are still at high altitude.

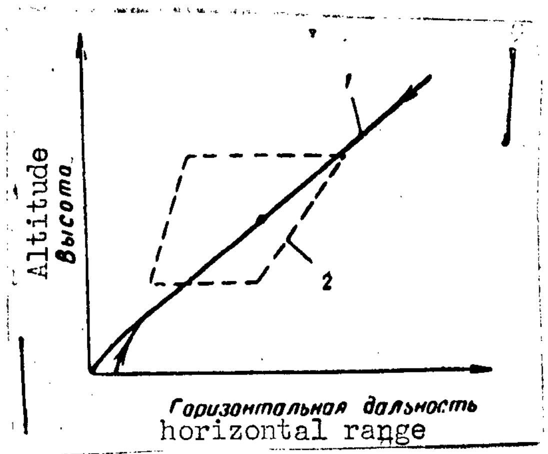

Fig. 6. ICBM interception with collision course: 1 - ICBM trajectory; 2 - interception zone.

Ordinary guidance methods in which the antimissile missile is constantly guided or flown toward the target are not used in ICBM interceptions since the closing speed of an antimissile missile and an ICBM can reach 9 km/sec. Specialists believe that this type of guidance problem is most easily solved by using a collision course or a course which is parallel to a collision course since an ICBM does not make sudden changes in its trajectory in the interception zone and excessive maneuvering for target interception is not necessary (figure 6).

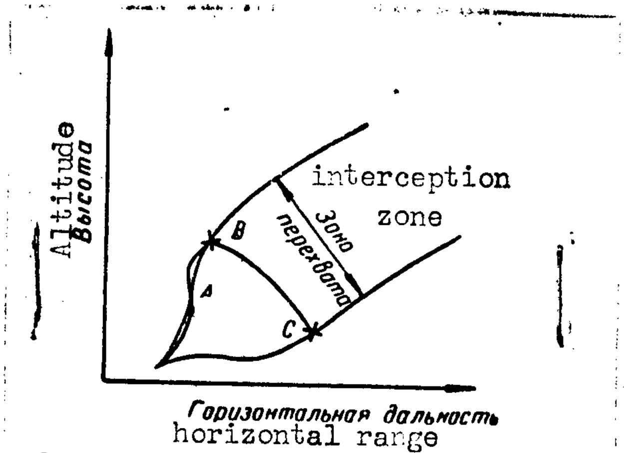

Рис. 7. Типовые траектории перехвата.

Fig. 7. Standard interception trajectories.

It is evident from figure 7 that if the target location is not known at the beginning of the interception and the attack is begun only when the target is identified, the guidance of the antimissile missile on a collision course follows trajectory A. In this way, the interception is successful if the target does not suddenly change speed. On the other hand, the antimissile missile is outside of the possible interception zone. This can be avoided if the interceptor is guided along trajectories B and C. More complex guidance is necessary for this, but the probability of target destruction is significantly increased. No error is permissable when guiding an antimissile missile to a target on a collision course.

When intercepting a target along a course parallel to a collision course with the antimissile missile and the ICBM maintaining constant flight speeds, the antimissile missile usually makes an S-turn for the target approach. Such a method of interception, as asserted in the foreign press, involves certain difficulties.

In the opinion of US specialists, target selection with interference and when an ICBM flying with decoy missiles, combatting maneuvering targets, development of an effective antimissile missile warhead, and determination of the expendiency of the principle of intercepting an ICBM during the terminal phase of its flight are all among the unsolved questions connected with the utility of the Nike Zeus system in combatting ICBMs. Specialists are also considering such factors as the 25% target destruction probability of the Nike Zeus antimissile missile. In confirmation of this, it was printed in the newspaper "Daily Mirror" in April of this year that in a secret session of the Senate discussing the question of rocket armaments, one senator declared that out of 90 launches of Nike Zeus type rockets, only three had hit the target.

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In connection with this, many ideas for conducting research and for searching for new methods for destroying ICBMs were expressed last year in the foreign press, chiefly in the US press.[2] This new research is related to the study of the possibility of developing and using means of antigravitation, antimatter, and radiation weapons. This sort of talk as related in the press concerns the use of the direct or indirect effect on a rocket of a narrow, projected beam of radiation from various parts of the electromagnetic spectrum from superhigh radiowave frequencies [SVCh] to X-rays or of high energy particle radiations. Weapons based on the use of these radiations are called "death rays" or "radiation weapons."

It is supposed that in the development of a radiation weapon to combat ICBMs, the following factors can be used: the direct effect of powerful laser beams - of quantum mechanical generators of optical or infra-red bands; the direct effect of powerful radiofrequency radiation, in particular of the superhigh freqencies and the radiations from several other areas of the electromagnetic spectrum; the use of strong shock waves produced by the discharge of artificial lightning developed by powerful radar beams; the use of the plasma sheath which forms around a rocket when it enters the atmosphere by influencing it with powerful radar or laser beams; the use of high energy particle flows; the use of the hypothetical possibility of developing antimatter, antigravity, etc.

American specialists believe that what are called "death rays", which are not yet developed, would be an ideal means for combatting ICBMs. The use of such rays is based on the fact that they can be radiated with the speed of light and the supposition that they will not require computers to forcast interception points and to work out commands for antimissile guidance. However, foreign specialists assume that with the present state of research the development of any effective means of ICBM defense using radiation weapons will probably require at least five and possibly even ten years of work.[3]

In a speech at a meeting of voters of the Kalininskiy electoral district of Moscow on 16 March 1962, N. S. KHRUSHCHEV said, "The time is long past when the US could consider itself invulnerable in war, protected from theaters of military action on other continents by huge expanes of ocean. At present, they are as vulnerable as any other country on the Earth. The situation has been changed even more now. Our scientists and engineers have developed a new intercontinental rocket which they call a global rocket. This rocket is invulnerable to antirocket weapons." Concerning this, it should also be noted that with this estimate of rocket defense of the US and other imperialistic states, they are preening themselves with military might and threatening the Soviet Union and the countries of the socialist camp with the unleashing of a new war.

1. "Interavia Air Letter," No 4247, 1959.

2. "Aviation Week," December 1961; "Electronics," May 1960.

3. "Aviation Week," December 1961.

FROM THE HISTORY OF PVO TROOPS

Victory Belongs to the Brave and Skillful -- by Lt Gen Avn (Ret) N. A. KOBYASHOV (Pages 77 - 80)

Abstract:

Discusses Soviet successes in defending the USSR from German air attacks during World War II and points out reasons for some of the successes such as coordination between antiaircraft artillery and fighter aviation elements or development of aerial combat tactics.

(A captioned photograph dated 1942, showing HSU B. PIROZHKOV in front of his fighter aircraft, appears on page 78.)

(A captioned photograph dated 1941 of HSU I. ZABOLOTNYY, fighter pilot, appears on page 79.)