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Herald of Antiaircraft Defense

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Vestnik Protivovozdushnoy Oborony, No 3, March 1963

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IN CHASTI AND PODRAZDELENIYA OF OUR TROOPS

Elected Representatives of the People (Page 2)

Summary:

Elections of deputies to the Supreme Soviets of Union Republics and to local soviets of workers' deputies were recently held. The elected deputies include members of PVO Strany Troops, such as Lt. Col. M. VORONOV, deputy to the Sverdlovsk City Soviet of Workers' Deputies. VORONOV was in command of the rocketeers who shot down the U-2 plane on 1 May 1960.

Among the deputies elected to the Moscow, Leningrad, Baku, and other soviets of workers' deputies, are veterans of World War II, as well as young officers, experienced political workers, and outstanding specialists in combat and political training. Heroes of the Soviet Union V. KUBAREV, G. PULOV, and others, have become elected representatives of the people. The best (radio or radar?) operator, Pfc V. NAZAROV, was elected deputy to one of the local government organs.

Circulating Honor Rolls -- by V. A. VIKTOROV (Page 2)

Summary:

By order of the commander of the Moscow PVO District, circulating honor rolls (knigi-estafety) entitled "Patriotic Achievements of Soldiers of the District" have been instituted. These books are routed through all chasti and they contain the names of soldiers who have gained outstanding achievements in combat and political training.

Medal for Bravery -- I. P. PETROV (Page 2)

Summary:

A Medal For Bravery was awarded to Pvt Konstantin Viktorovich ZHIGALKOVSKIY, serving in an aviation chast', for his courage and quick-thinking action in saving the life of a pilot, Capt TOMASHIN, whose fighter plane had caught fire when landing on the airstrip after returning from a night training flight. ZHIGALKOVSKIY, a member of the ground crew, immediately drove up to the plane with a fire extinguisher and was able to put out the fire, thus preventing an explosion.

A captioned photograph by I. RYBIN shows Re-enlisted Sgt G. BALYSHEV working on one of his innovation projects. BALYSHEV has done much work in searching for efficient methods of utilizing combat equipment and has submitted more than ten innovation suggestions, many of which have been put into use. (Page 2).

To the Soldiers of the Soviet Armed Forces (Pages 3-4)

Abstract:

An article signed by the Central Committee CPSU, the Presidium of the Supreme Soviet USSR, and the Council of Ministers USSR, conveys greetings and best wishes to all members of the Soviet Armed Forces on the occasion of the 45th anniversary of the Soviet Army and Navy, praising the achievements and the might of the Armed Forces. The article appeals to all military personnel to increase their vigilance and combat efficiency in view of the continuing danger of aggression by imperialist countries.

The Principal Task of Party Organizations -- Editorial (Pages 5-8)

Summary:

Lenin's idea of the decisive importance of party supervision of the Armed Forces has been reincorporated in the new Party Program. In recent years, the party has carried out a number of important measures toward improving party-political work in the army and increasing the role of political organs and party organizations in all activities of the troops.

The decree of the October 1957 Plenum of the Central Committee CPSU "On Improving Party-Political Work in the Soviet Army and Navy," was of historical significance. According to this decree, statutes for military councils and political organs, and instructions for party and Komsomol organizations in the Soviet Army and Navy, were approved.
Party committees were established in regiments and on ships, in military educational institutions and scientific research institutes, in staffs of military districts, and in the central apparatus of the Ministry of Defense. Party organizations in battalions acquired the rights of primary party organizations. Subsequently, on the basis of the CPSU Program and the Party Statutes adopted by the 22d Party Congress, appropriate changes were made in the Statute Concerning Political Organs and the Instructions For Party Organizations.

According to the Instructions, the principal task of party organizations is to implement the requirements of the CPSU Program with regard to organization, discipline, efficiency, and combat readiness of the Armed Forces.

In the case of party organizations of PVO Strany Troops this means that the entire activity of party organizations must be subordinated to the successful fulfillment of the basic task, i.e. maintaining constant readiness for action in order to dstroy any aggressor who might try to invade the air space of the Soviet Union.

A high degree of combat readiness depends mainly on the level of combat training and political consciousness of the personnel. Party organizations play an extremely important role in solving tasks of combat training and political education. It is their duty to inspire the personnel to acquire a high degree of perfection in military skills, to help commanders in correcting shortcomings in the training process and in the assimilation of leading achievements, and to conduct a relentless struggle against laxity and oversimplification in the training and education of personnel.

Many party organizations meet these requirements in the proper way and help commanders to attain a high quality of combat and political training, by analyzing the reasons for any shortcomings and helping to eliminate them.

However, some party organizations do not take enough interest in the training process and put up with oversimplification in tactical training. This practice of "noninterference" in matters of combat training produces negative results.

All party leaders and party members should be fully familiar with the combat training plans and the specific tasks of a chast' or podrazdeleniye, and should be able to explain them in detail to the personnel. Party organizations must be strict in their demands toward all those who obstruct the introduction of new, efficient methods.

One of the main tasks of party organizations is to strengthen one-man command and discipline, by increasing political education, giving proper attention to the needs and requirements of the soldiers, and campaigning against any misinterpretations of disciplinary practice.

The party committees of higher and secondary educational institutions should be constantly concerned with improving the teaching process and helping to solve problems of scientific research work for the purpose of increasing the combat readiness of PVO Strany Troops.

With the use of criticism and self-criticism, army party organizations must expose shortcomings in the training and education of personnel and in party-political work. According to the Instructions, party members have the right to criticize any party member or candidte at party meetings, regardless of that person's position, as long as such criticism furthers the increase of combat readiness and the general strengthening of one-man command and discipline. Therefore, criticism of orders and instructions issued by commanders and chiefs is not permitted at party meetings.

An improvement in the work of party organizations depends to a great extent on their supervision by political organs. According to the Statute Concerning Political Organs of the Soviet Army and Navy, the political organs are obliged to supervise party organizations on the basis of strict observance of Leninist norms of party life; to develop the initiative and

active participation of party members in carrying out party decisions and combat training tasks; to further criticism and self-criticism in party organizations, and to react promptly to critical remarks and suggestions.

Some political workers tend to forget these immediate duties. When visiting military units, they merely register shortcomings. However, their main task is to train party activities in the art of educational and organizational work, and to give specific, expert assistance to chasti and podrazdeleniya in carrying out their tasks.

In concentrating their attention on the main issues, i.e. increasing combat readiness and fulfilling plans of combat and political training, army party organizations must be even more purposeful in their organizational and ideological education work.

Officer Cadres Must Be Carefully Trained -- By Maj Gen Avn S.G. PANOV (Pages 9-14)

Summary:

According to the Party Program, command personnel must persistently engage in mastering Marxist-Leninist theory, have a high degree of military-technical training, meet all requirements of modern military theory and practice, and strengthen military discipline. To be able to cope with their responsible duties, officers have to be thoroughly familiar with Marxist-Leninist theory, which forms the methodological basis of Soviet military science, and they must have high technical skills.

The PVO Strany Troops are armed with the most modern equipment and powerful means for defeating any aggressor. The effective utilization of this equipment depends to a great extent on the officer cadres, who have been entrusted by the party and the government with the training and education of personnel, and with the maintenance and preservation of equipment in a state of constant combat readiness. Therefore, every Soviet officer must be guided by the Leninist requirements to coordinate training and education in a skillful manner.

Officers who are guided by this principle and constantly seek to increase their knowledge in the shpere of Marxist-Leninist theory, are able to cope successfully with their duties. (An example follows.)

Such officers are in the great majority. They are not only well trained specialists, but skillful political leaders who are versed in the art of training and educating their subordinates.

It is primarily the duty of political organs and party organizations to see that officers constantly raise their ideological and theoretical level, and to help them systematically in the study of Marxist-Leninist theory. (A party organization is mentioned as an example)

Occasionally one meets officers who are not seriously concerned with perfecting their military and political knowledge. After graduating from educational institutions, they are content to live with what they have previously learned; this has a harmful effect on the combat and political training of their subordinates. (Several examples cited.)

Commanders, political workers, and officers of personnel organs, must be thoroughtly familiar with the strong and weak points of every officer, help him whenever necessary, and point out what requires his greatest attention so that he may perform his duties successfully. Some personnel officers neglest to study the traits of individual officers and often forget about them after they have been appointed to their posts. This is a serious shortcoming in the work with personnel.

In addition to showing interest in the Marxist-Leninist education of officers, one should give them every possible aid in increasing their military technical knowledge, which is of extreme importance in modern warfare with its fast-moving and highly maneuverable operations. In addition to specialized military knowledge, an officer must have a wide range of general technical knowledge, and a thorough familiarity with physics, mathematics, and chemistry, which forms the theoretical basis of modern equipment and weapons. A lack of knowledge on these subjects would seriously hamper the training and education of personnel. Therefore, a continuous perfection of engineering and technical knowledge and skills is one of the most important present requirements with regard to officers.

An officer must also have the proper organizational qualities to be able to train and educate his subordinates in a successful manner. In this respect, senior commanders and chiefs can do much to help young, inexperienced officers by their personal example.

It happens occasionally that young officers fail to receive the necessary attention and help. As a result, they lose their confidence and do not develop their capabilities to the fullest extent. This may lead to loss of morale and "the desire to get out" (demobilizatsionnyye nastroyeniya). Commanders and political workers should take all this into consideration and create the necessary conditions so that young officers may perform their duties successfully.

An officer must be demanding toward himself and his subordinates and must not tolerate the slightest infractions of military discipline. At the same time, he must show concern for their increased political consciousness and for their welfare.

An officer's authority is indispensable for achieving success in the training and education of personnel. To gain authority, an officer has to be not only an expert in his field, but should set a high, moral example.

The PVO Strany Troops are faced with highly responsible tasks, and the continued improvement of their combat readiness depends to a great extent on the successful solution of these tasks. It is the duty of senior commanders and chiefs to improve the placement of personnel, as well as their ideological education and technical training, and to raise every officer's sense of personal responsibility for the job entrusted to him.

Recipients of High Awards (Captioned photographs on pages 10, 11, 12, and 13).

Summary:

Capt Farid Makhmutovich AYUPOV, commander of a radar company, was awarded the Order of the Red Star for excellent results in combat and political training and successful mastery of modern, complex combat equipment. The podrazdeleniye under his command has been the leading one in the Nth radiotechnical chast' for a number of years. He has been able to train many first-class radar specialists. He was formerly a political worker and was then promoted to a command position. Capt AYUPOV is constantly striving to improve the combat preparedness of his podrazdeleniye.

Col Aleksandr Yakovlevich MIKHAYLOV was awarded the Order of the Red Star for outstanding military services, on the occasion of the 45th anniversary of the Soviet Armed Forces. During World War II, he was awarded the title "Hero of the Soviet Union" for his heroism in comabt. He has shown excellent qualities as a commander and most of the soldiers under his command have excellent ratings in combat and political training.

Maj Pavel Yeremeyevich BONDAREV was awarded the Order of the Red Star for his services in training and educating his subordinates, in improving combat readiness, and in the mastery of equipment. He is an able educator and good organizer of combat and political training in the podrazdeleniye under his command. His podrazdeleniye has had an excellent rating for over 2 years.

Maj Vladimir Aleksandrovich SHKLYAREVSKIY recently received a promotion in position and was awarded the Order of the Red Star for his excellent results in combat and political training and successful mastery of modern, complex combat equipment. He is an experienced commander and has done an outstanding job in training the personnel of the podrazdeleniye under his command.

PARTY-POLITICAL WORK AND MILITARY TRAINING

Give Unremitting Attention to the Ideological Training of Youth --

By Capt V. A. MITROSHENKOV (Pages 15-19)

Summary:

The Komsomol is an educational organization. Its primary task is to educate young people to be true Leninists and ardent, ideologically convinced fighters for Communism.

Komsomol organizations in the Army are responsible for increasing the political consciousness of Komsomol members, educating young soldiers in the ideas of Marxism-Leninism, explaining the policies and decisions of the party and government, carrying them out firmly and consistently, and acquainting young people with the extenisve achievements in building Communism.

Komsomol organizations of the Moscow PVO District have noticeably improved the ideological education of young soldiers. Ideological education is most effective when it is closely coordinated with the political study system, in the course of which soldiers and sergeants study the ideas of Marxism-Leninism, acquire basic knowledge in party history, study the policies of the party and the Soviet government, and learn about the historical role and present tasks of the Soviet Armed Forces.

A considerable number of young officers are Komsomol members. Therefore, Komsomol committees as well as commanders and party organizations should show continuous interest in the theoretical training of officers who are Komsomol members.

Until now, individual secretaries, bureaus and committees of the Komsomol sometimes keep aloof from the planned political training of soldiers, as they consider this to be the concern of commanders and political workers. Of course, commanders and political workers are responsible for the organization of political training of the personnel. However, Komsomol organizations cannot remain indifferent to the progress made by Komsomol members in their political studies. This Komsomol policy of non-interference should not be tolerated. New ways must be found to help soldiers and sergeants in their political studies, and to aid officers in the study of Marxism-Leninism.

One of the most important forms of ideological training is the organization of lectures for the propaganda of party decisions, party program, the moral code of builders of Communism, and Komsomol traditions.

A Komsomol organization headed by Sr Lt MOLOKOYEDOV formed an agitation brigade, the members of which give talks to the soldiers of units located at great distances from the chast'.

Open Komosomol meetings devoted to matters of political and military training are of considerable importance for the ideological growth of young soldiers. Literary evenings have become widely popular. Komsomol and youth evenings are frequently devoted to questions of the international situation, Communist ethics, and many other problems of interest to youth. Youth discussions have produced good results.

The Communist education of youth is closely connected with the development of a high cultural level. The Komsomol members of chasti have recently established closer ties with creative art organizations, with writers, composers, artists, and journalists. On the initiative of Komsomol members, universities and lecture courses have been organized in many garrisons.

However, there are still many shortcomings in the ideological education of youth, such as formalism and lack of purposefulness. Propaganda and agitation are often conducted in a dry and uninteresting manner. Some Komsomol leaders try to do everything in a sober and pompous fashion, forgetting that young people will be young, and that they appreciate a joke, a smile, or a gay somg. Therefore, one should not force upon young people "too adult" methods of education by merely copying activities of party organizations.

Not enought attention has been given to explaining the requirements of the Military Oath and of service regulations. As a result, there have been violations of military discipline, and a negligent attitude on the part of some soldiers, including Komsomol members, toward their military duties. The struggle against signs of bourgeois ideology, vestiges of the past, religious prejudices, and lack of political interest, is not always conducted in a forceful and active manner.

The many shortcomings in ideological education may be explained partly by the fact that some Komsomol leaders fail to consider the increased party requirements in the education of youth, and do not realize that a new approach must be used to the solution of many problems of the education of soldiers.

Komsomol leaders and all activists should critically analyze the situation in their organizations, expose the shortcomings and their causes, and take necessary steps to improve the ideological education of youth.

Chronicle of Komsomol Life (Page 17)

Abstract:

Reference is made to measures taken by Komsomol organizations in various chasti to improve educational work and technical training. One item mentions a group organized at the suggestion of a Komsomol organization headed by Sr Lt KEPEL', devoted to the study of nuclear physics and its importance in military developments. Classes are reportedly

conducted by experienced officers, associates of scientific research institutes, and engineers.

An Important Part of the Work of Commanders and Political Organs --

By Col A. P. KIRICHUK (Pages 20-23)

Summary:

Most of the young officers who graduate from secondary and higher military educational institutions have a good specialized and general education, but they lack experience in working with people, as well as adequate ideological training and the necessary skill in commanding podrazdeleniya and handling combat equipment. Therefore, during the initial period they are greatly in need of advice and help from senior commanders, political workers, party and Komsomol organizations, and all other officers. This was mentioned by Mar SU R. Ya. MALINOVSKIY in one of his speeches.

Most of the chasti of PVO Strany Troops give a warm welcome to young officers and create the necessary working conditions for them. Lectures and seminars are organized to acquaint the young officers with training methods, problems of discipline, vigilance, maintenance of equipment, and other matters related to the service in PVO Strany Troops.

To be able to cope with their tasks, young officers must continually expand their political horizon and master the ideas of Marxism-Leninism. Some young officers, upon joining a chast', give themselves a "vacation" from political training, hoping to get by with what they have learned in school. For example, Lt GRACHEV, who took part in a Marxist-Leninist study group, failed to read a single recommended work.

Commanders, political workers, and secretaries of party and Komsomol organizations should see to it that all young officers take part in political training and raise their ideological level in the proper manner.

Unfortunately, not all commanders and chiefs find time to attend political classes, and to talk to the young group leaders about their problems. In some places, seminars for leaders of political study groups are held irregularly or are replaced by brief instruction periods, which do not satisfy the requirements of inexperienced propagandists.

An understanding, individual approach to young officers by senior commanders is of the greatest importance and produces the best results. The help given to young officers should not prevent them from acting independently and using their initiative. They should not wait for instructions or advice from their seniors in every single instance. The qualities of independent action and initiative should be developed and encouraged in young officers. However, under the pretext of letting

young officers act independently, senior chiefs should not stop helping them and checking their work. As a result of such a practice, young commanders often overestimate their abilities and cease to improve their military and political knowledge, which has a negative effect on the training of their subordinates.

Political organs and party organizations must constantly help the senior chiefs to improve the command qualities of young officers, raise their authority, and take the necessary steps to improve their living conditions.

Most young officers are members of the Komsomol. Therefore, Komsomol organizations play an important part in the officers' education. (A captioned photograph by K. FEDULOV, showing Sr Lt I. CHEBINEV, party secretary of a podrazdeleniye, during a discussion on the international situation and internal events, appears on page 23).

The Search Was Crowned With Success -- Capt V. V. STULOVSKIY (Pages 24-26)

Summary:

Capt Boris Sergeyevich IVANOV, secretary of a party committee, in addition to his party activities, spends much of his time improving his technical knowledge and working on innovations to improve the operation of equipment under combat conditions. After a number of experiments, he found a way to adapt a telescopic antenna of an ultrashort-wave radio set for use with a medium-wave transmitter, thereby improving the reliability (zhivuchest') of antenna fields. He also devised a method to make the antenna blast-proof by lowering it into a concrete-reinforced shaft. (Capt IVANOV's photograph, taken bythe author of the article, appears on page 25).

A captioned photograph by I. SEREGIN, showing Maj V. YEREMIN, Pilot 1st Class and squadron commander, and Capt L.VOLOKHOV, Pilot 1st Class, during a discussion of an exercise with a training apparatus, appears on page 26. The pilots of the outstanding squadron under Maj YEREMIN's command engage in pre-flight training by using every possible means to increase their skill and master the tasks awaiting them during flight training.

COMBAT TRAINING

Raise the Role of Staff Officers in the Organization of Combat Training --

By Maj Gen Arty P. T. ANDRYUSHCHENKO (Pages 27-30)

Summary:

Staff officers of the PVO Strany Troops have an important role in the solution of responsible tasks. They are expected to give expert and practical help on matters concerning the organization of combat and political training, maintenance of a high level of combat readiness, and the education of personnel. This requires all staff officers to have a high degree of general military, political, tactical, and technical training. They must be first-class specialists, experts on methods, and propagandists of outstanding achievements. It is the duty of staff officers to foresee the possible difficulties of troops in performing their missions and to give them help at the proper time.

The principal method of staff officers' work is to work directly with the troops. This work should not only consist of inspections and checks, but should be mainly concerned with the propaganda of leading methods in the organization of combat training, and the discovery and correction of deficiencies on the spot. Officers of higher-ranking staffs are called upon to give assistance to commanders of chasti and podrazdeleniya and to officers of lower staffs, by conducting specialized training classes and by permitting the commanders and officers complete independence and initiative in their work.

One of the important responsibilities of staffs is the planning of combat and political training. The success of troop training depends on the efficiency of planning the training process. The plan should represent a practical guide for the organization of combat training, a "code of laws" for a definite period of the year, or even for a whole year. It should be clear and precise, and should not contain any generalities. This can be achieved if the staff officers in charge of planning are thoroughly familiar with the training missions, and have a perfect knowledge of the methods of carrying out such missions, as well as the specific details of training. Many staff officers correctly take into account any deficiencies in former planning and the achieved training level of the troops.

At the present time, the plan for all chasti and podrazdeleniya is based on the complex training method. However, some staffs interpret complex training merely as a formal utilization of aviation in their own interests, which is entirely incorrect in the system of troop training. Complex training should be the training of podrazdeleniya chasti of all branches of the army, and their welding together into a whole. The results of this depend to a great extent on the staff officers and on their thorough familiarity with training tasks of command posts, chasti, and podrazdeleniya, and their ability to coordinate such tasks.

Each staff officer must have perfect knowledge of functional duties and the duties must be correctly assigned to them according to specialties.

During the entire training year, staff officers are called upon to check the fulfillment of plans for combat and political training, and to help eliminate any deficiencies they might discover as a result of their checks.

Staff officers are responsible for conducting specialized training classes with the troops, and for preparing methods manuals and analyses.

One of the principal ways to increase combat readiness and the training level is to analyze and publicize the leading achievements of the best staff, chasti, podrazdeleniya, crews, officers, sergeants, and soldiers. This should be done on a continuous basis.

Staff officers should make a careful study of the experience gained by personnel during various training exercises and introduce the best methods into practice.

In their practical work, staff officers are obliged to give attention to the availability of textbooks and other teaching facilities in podrazdeleniya. They help to prepare teaching aids and introduce methods of automation and mechanization of control, as well as teaching methods with the help of machines.

At the end of each month, meetings of methods councils are held in the chasti to sum up the training results for that month. Staff officers have an extremely important role in preparing and conducting these meetings, and it is their duty to see that the materials presented at the meetings contain a thorough analysis of the state of combat training, military discipline, the progress of socialist competition, references to shortcomings and their causes, as well as specific ways to eliminate them. Diagrams should be presented at each meeting, showing the results of combat training and the state of military discipline.

The service activities of officers would not be complete if they were unable to replace one another whenever necessary. Therefore, staff officers should carefully study the combat properties and combat utilization of all kinds of equipment and weapons.

Among the many various functions performed by staff officers, one should not forget the functions of educating the personnel of podrazdeleniya and chasti. Many staff officers are engaged in educational work and show a good example by their understanding attitude toward the requirements and complaints of personnel. At the same time, they are demanding and uncompromising toward violations of rules and military discipline.

(A captioned photograph by F. KONSTANTINOV, showing Sr Engr-Lt V. OSMOLOVSKIY helping Pfc S. DEMCHENKO, an operator, to understand a

radiotechnical diagram, appears on page 30. Sr Engr-Lt OSMOLOVSKIY enjoys great authority with the personnel because of his excellent knowledge of combat equipment and the ability to transmit his knowledge to subordinates.)

When Each Moment Is Precious -- by Maj D. P. VLASOV (Pages 31-34)

Summary:

PVO rocketeers must be constantly concerned with increasing their combat readiness, finding unutilized reserves, and making every second in their work count.

A certain podrazdeleniye may be taken as an example. In preparing equipment for combat, special attention is given to "details" so that a few seconds may be gained. Rocketeers constantly watch the actions of every single crew member, thereby finding new reserves in saving time. A contest was once held between Komsomol members of different crews to determine which crew could prepare a rocket for launching faster and better. The contest was judged severely and impartially, and every error was criticized. Attention was given not only to the speed of operation, but to precision and to interchangeability. Sr Lt ROMANCHENKO carefully watched the observance of safety measures. He had learned a bitter lesson in his life. On one occasion, the soldiers placing the training rocket on launch apparatus were too much in a hurry and forgot about safety measures. Although they noticed that the rocket was not properly aligned, they paid no attention to it. As a result, the rocket toppled and fell to the ground, bending the stabilizer and wing.

Not only launch crews, but control crews are also trained to make every moment count. Operators must be trained to replace one another if necessary by studying several related specialties.

The guidance officer also has to take part in the general effort to save time. A great deal of training was necessary to make the operators give their reports in a clear and precise manner. Formerly, they used to speak in a low voice, not clearly audible; they "swallowed" word endings and placed the wrong accent. One private slurred the word "sixty" so that the officer had to ask him to repeat it. Time was lost in this way. After much training, these shortcomings were corrected.

The commander of one podrazdeleniye was not satisfied with the fact that it took longer to prepare rockets for launching at night than it did during the daytime. After discussing the matter with officers and commanders of crews, the training of rocketeers was intensified and a number of innovations were introduced. Finally, a time study was made to see if any more seconds could be saved. It was discovered that some operations of rocketeers consumed more time than provided by the daily

noms, and other operations required less than the prescribed time. Sr Lt ROMANCHENKO undertook to correct this disproportion by additional, intensive training, which was conducted mainly at night, under conditions of limited visibility. After long periods of persistent training, the rocketeers of the podrazdeleniye attained a high level of perfection.

In Defiance of Wind and Frost -- (Pages 32-33)

Summary:

During a heavy snowstrom, at a temperature of minus 40°C, the radar station of a remote garrison suddenly found its communications line disrupted. Lt POPOV decided that is was necessary to reestablish communication without lowering the antenna mast, and instructed Reelisted Jr Sgt MANNS to carry out the repairs. Jr Sgt MANNS carried out the assignment under the greatest difficulties and was able to repair the antenna. (A Photograph of Reenlisted Jr Sgt R. MANNS appears on page 32.)

Utilization of Ground Facilities to Ensure Flight Safety -- Col D. A. KRIVOV, Pilot 1st Class (Pages 35-38)

Summary:

To ensure flight safety and a skillful use of ground aids to navigation, a flight control officer must be in possession of precise data on visibility, weather changes, and type of clouds, over the entire flight area. Therefore, a reconnaissance plane is sent out from time to time in the direction where a change of weather is expected, and reports are received from this plane

During a night training flight under unfavorable weather conditions, with minium visibility, the distant-reading gyromagnetic compass suddenly ceased to operate. The pilots reported it to the flight control officer, and with the use of a radio compass and data provided by the radio direction finder, the plane was able to make a successful landing on the landing strip.

Despite reliable and continuous flight control from the ground, the crew must always know the location of their plane. This can be achieved by keeping track of the time since take-off, keeping strictly on course, and taking into account the flight time after each change of direction. Together with readings of the navigation instruments and data from the ground, these calculations make it possible to determine the location of the plane fairly accurately. Therefore, all flight personnel must regularly study the facilities of ground aids to navigation and be trained to use them.

There must always be two-way radio communication between planes in the air and the flight control personnel on the ground. The maintenance

of "radio discipline" in the air is one of the primary duties of a flight control officer.

Under present conditions, flights are unthinkable without radio-technical control. All flights are carefully checked by radar operators.

Experience has shown that during a flight it is difficult to calculate the speed and direction of the wind according to altitude, and this may lead to deviations from the course. Therefore, the pilot must use ground naviagtion aids to check his course. The flight control officer, who watches the flight on radar, can determine any significant deviation from the flight course and is able to correct the pilot, in event the latter has not noticed his error. If the mavigation equipment, such as the automatic radiocompass, should cease to operate, the flight control officer can guide the plane to the landing field.

The use of radar for the control of planes in the air not only increases flight safety, but provides greater possibilities for the control of crews. This is clearly demonstrated by the method of guiding individual planes and groups of planes to a landing under difficult weather conditions.

Some pilots rely only on their instrument readings and believe that they do not need any kind of corrections from the ground. This is wrong, since instruments may occasionally be in error and the pilot himself may make mistakes in the landing approach method. Therefore, a pilot must accurately obey all orders received from the ground, which will enable him to make a proper landing.

Failure to obey the established rules, or carelessness in handling the controls of a plane, are threats to safety. This applies especially to the final stage of the flight, the descent for landing. Failures to listen to ground instructions, as well as errors in piloting, may lead to collisions of planes coming in for a landing.

The ground aids to navigation at Soviet airfields are completely reliable for ensuring safe flights. However, all flight personnel must be completely familiar with the facilities of ground equipment and their use to prevent the possibility of accidents under difficult flying conditions. A serious accident was barely prevented, when Sr Lt LEBEDEV who was coming in for a landing misinterpreted the signals from the ground, as he was insufficiently trained and unfamiliar with elementary rules which would enable him to make a safe landing under unfavorable weather conditions.

It is of great importance to know the location of the radio direction finder on an airfield. It is located near the inner marker beacon, aligned with the runway, and it is of great help to the pilot when approaching for a landing under difficult weather conditions, or in the

event of a failure of the automatic radio compass. (A captioned photograph by I. RYBIN, with text by Capt V. KOROTKOV, on page 37, shows Maj Gen' Avn V. F. GOLUBEV, HSU, in a discussion with Pvt Valentin MOSIN during a conference of innovators and inventors. Pvt MOSIN has devised a new, improved type of training apparatus which has made it possible to solve many problems of training pilots for modern fighter planes. Pvt MOSIN received a special award for his work.)

Methods for Perfecting the Training of Operators -- by Engr-Capt V. I. KONDRATENKO (Pages 39-41)

Summary:

The combat readiness of radar stations depends to a great extent upon radar operators. They must know not only how to detect and track targets, but also how to make equipment repairs. This requirement is constantly growing in complexity. Recently it has become necessary for radar operators to know how to carry out the functions of any of the other specialists in their crew and to be able to operate any of the radar equipment of their podrazdeleniye. Thus, every radar operator should develop his knowledge to the level of that of a radar technican.

Many radar operators do not have firm knowledge of their equipment, which is shown by their usage of equipment and their inability to execute basic combat assignments. The main reason for this is that there are shortcomings in the training which they receive. They are required to study independently to gain knowledge of some equipment, but they do not have a deep knowledge of electronic equipment principles. Thus, they attempt to memorize the operation of blocks mechanically without thoroughly understanding the physical processes involved. To correct this, we suggest that the number of school hours spent on the bases of radio electronic equipment be increased and that some changes be made in the training schedule so that immediately prior to the study of a component, its electronic fundamentals are mastered. Technical circles at training institutions can play an important part in training by planning activities which correspond closely to school training activity.

Training groups have many more personnel than are in a radar crew. It is therefore difficult to cover sufficient material or to investigate the necessary number of types of equipment. Also, training groups are not constantly occupied with radar equipment as are combat radar crews. This can and does result in a gap between the theoretical knowledge and the equipment operation skills of young operators when they leave a training podrazdeleniye. We suggest here three ways to overcome this deficiency: first, training should be organized in such a way that study of a subject is done in a manner parallel to the study by combat crews on equipment, which is carried out directly on the equipment itself; second, platoon commanders from combat units should be brought in to instruct in specialized

subjects; and third schedules round-the-clock combat duty by students in radar stations should be provided.

The interest of commanders and sergeants and their participation in training activities is important and the relating of experiences by skilled personnel is of great use to students.

(The caption to a photograph by K. FEDYLOV on page 41, which shows Capt ALSAYEV and three of his subordinates studying a circuit diagram of a radar set component, states that ALSAYEV's subordinates have retained a transferrable banner for two years.)

Achievements of Science and Technology in the Training Process -- by Engr-Col G. N. SMORCHKOV and Engr-Maj V. K. PILETSKIY (Pages 42-44)

Abstract:

States that scientific and technological advances in air defense equipment are so rapid that graduating officers must be provided with sufficient knowledge to have the potential to master new technical achievements while in the field. Successful resolution of this problem at the authors' higher educational institution is provided by the timely inclusion of courses concerning planned new developments and equipment; by increasing the work and importance of methods commissions; by regularly organizing methods conferences; by creating new graphic training aids; and by carrying out course activities on a high scientific and theoretical basis.

(A captioned photograph by F. KONSTANTINOV on page 43 shows Capt Tech Serv I.KHAIZOV, specialist first class, explaing to Jr Sgt Ye. GRIBCHENKOV, mechanic, how to check a sight following maintenance.)

Preflight Medical Examinations of Flight Personnel -- by Lt Col Med Serv M. D. MARTYNENKO and Maj Med Serv V. V. KOBLYANSKIY (Pages 45-47)

Abstract:

States that the increased speeds, ceilings, and ranges of contemporary aircraft complicate the physical and emotional processes of flight personnel and discusses the importance of preflight physicals, the responsibilities of flight surgeons, and the medical responsibilities of flight personnel and flight controllers.

(A captioned photograph by K. FEDULOV on page 47 shows Pilots 2d Class A. LISOVSKIY and V. AMEL'KIN discussing an interception of an aerial target in difficult weather conditions.)

Methods for Improving Radio Communication by Tropospheric Scattering of Radio Waves -- by Engr-Capt G. V. BARANOV and Capt (Res) V. F. OVCHAROV (pages 48-51)

Abstract:

Based on foreign press, discusses radio communication by tropospheric scattering of radio waves including angular spacing of antennae, amplifiers with small noise coefficients, transmitter power control, and receiver band pass control; mentions the USAF Dew Drop tropospheric communication system; and describes the Thin Route Tropo-Scatter Communication System as a new system of tropospheric radio communication with low-power, narrow-band transmitters. Foreign press source cited include: Microwave Journal, July 1961; IRE Transactions on Vehicular Communications August 1961; IRE International Convention Record, March 1961; Bell Laboratories Record, November 1961; and Signal, November 1961.

Illustrations and tables used in article follow:

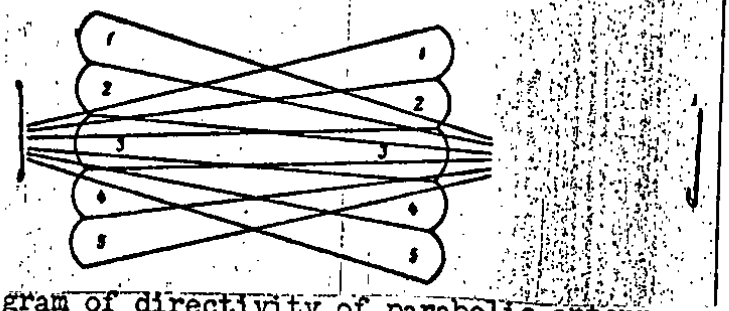


Figure 1. Diagram of directivity of parabolic antenna, swept by several horns.

Attachment

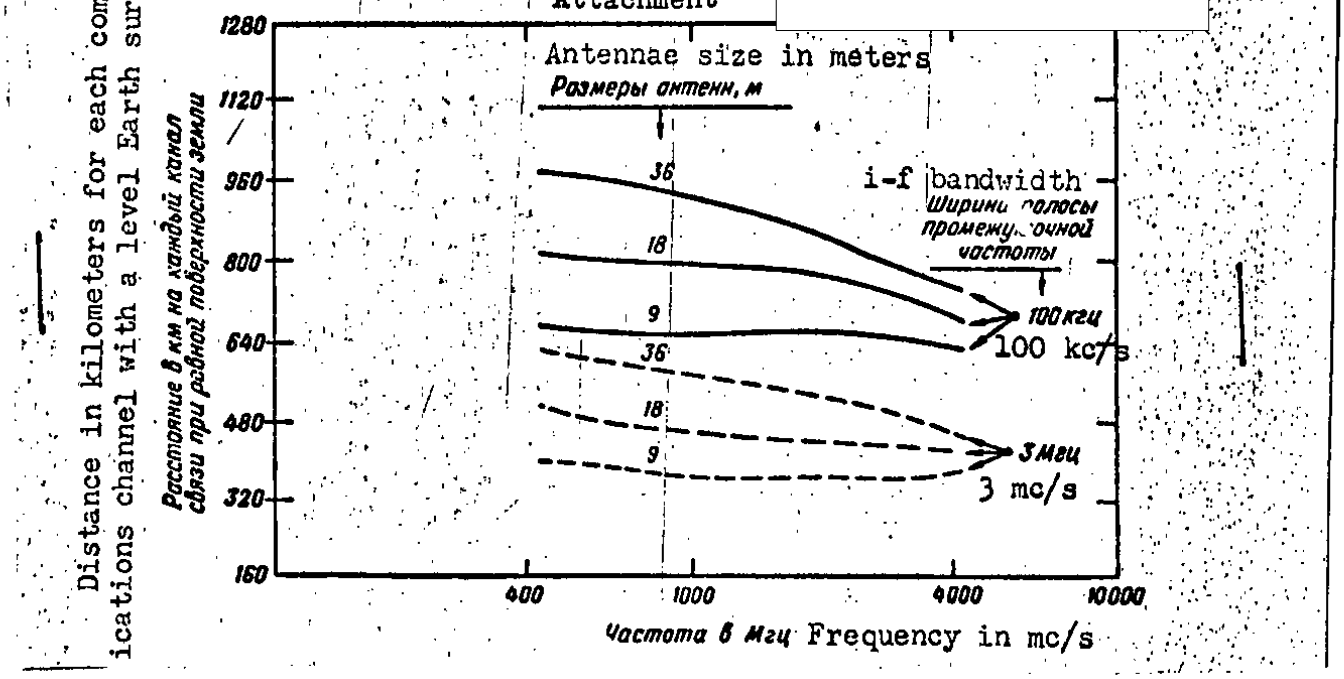


Figure 2. Maximum capabilities of tropospheric scattering systems (for each communication channel).

Relation of channel power to noise power at receiver outlet - 10 decibels; reliability - 99%; power - 50 kilowatts; quadruple scattering; receiver noise coefficient - 4 decibels.

Table 1. Data on Sizes of noise coefficients for various types of US amplifiers:

Type of Amplifier	Frequency Range	Noise Coefficient decibels
Triode	30 - 3,000	3 - 10
Semiconductor	300 - 1,000	1
Traveling Wave Tube	3,000 - 10,000	4 - 10
Molecular Generator	500 - 10,000	1
Parametric Amplifier	50 - 10,000	2 - 4

Table 2. Fundamental Tropospheric Communication Systems of US and other countries:

Countries	USA		Canada			Norway	Venezuela
System Name	Bell System	White Alice	Pole Vault	Mid Canada	Dew Drop	Ace High (part of a system)	...
Terminal Points	Miami-Havana (Cuba)	Alaska	Newfoundland - Labrador	Quebec - Labrador	Cape Dyer - Thule Greenland	Oslo - Bodo	Caracas - Maracaibo
Frequency Range mc/s	700 to 900	750 to 950	571 to 731	755 to 980	350 to 450	900 to 2,200	900 to 6,000
Average Power kw	10	1 to 10	10	2 to 10	10	10	1
Modulation	FM	FM	FM	FM	Single side band	FM	Single side band
Antenna size in meters	18	9 to 36	18	9 to 18	36	9 to 18	9
Spacing	quad	duplex	duplex reception	quadruple reception	quad	quad	quad
Number of telephone channels per receiver	36	12 to 240	12 to 36	36 to 108	24	36	24
Length of line segments in kilometers	300	160 to 320	210 to 365	145 to 220	1,100	160 to 320	

Equipment and Its Use

Safe Use of Automotive Equipment -- by Maj Gen Intendance Serv V. A. LEBEDEV (Pages 52-56)

Abstract:

Concerns the safe and economical operation of trucks, automobiles, tractors, caterpillars, etc. through discipline and training of operators.

(A captioned photograph by S. IVANOV on page 55 shows Capt KOBETS, motor transport company commander, discussing correct tractor operating procedures with two tractor drivers.)

(A captioned photograph by P. GORDIYENKO on page 56 shows Tech-Sr Lt V.LABENSKIY carrying out a preflight inspection on a fighter aircraft.)

Strict Observation of Engine Operation Rules -- by Engr-Sr Lt V. M. CHAYKA (Pages 57-58)

Abstract:

Discusses the importance of preventive maintenance and correct engine operation, especially concerning diesel generators; engine corrosion and erosion of engine surface parts; harmful engine vibrations and their causes; harmful effects of heat; and methods of preventing harmful engine operation.

For the Aid of Training Leaders

Heterodyne "Image" Tuning -- by Engr-Capt N. S. KURBESOV (Pages 59 - 61)

Text:

Experience in the use of a radar set shows that its most important technical characteristics, i.e. range of object detection, coordinate measurement precision, resolving power, etc., depend essentially upon the precision of tuning the radio receiver to the frequency of the echo signals received by the set. How is a high precision of receiver tuning accomplished?

As is known, superheterodyne receivers are used in many types of radar sets. A functional circuit of a superheterodyne receiver is shown in figure 1. The internal conversion of echo signal frequency from nominal f_c to a lower, intermediate f_{pr} is an outstanding feature of such receivers. The value of f_{pr} is determined by one of the following conditions:

$$f_{pr} = f_c - f_r, \text{ if } f_r \text{ is smaller than } f_c; \qquad (1a)$$

$$f_{pr} = f_r - f_c, \text{ if } f_r \text{ is greater than } f_c, \qquad (1b)$$

where f_r is the heterodyne frequency.

If the operation of a radio receiver depends on fulfillment of condition 1a, index "N" is conferred to it; if it depends on 1b, it receives index "V".

The mutual arrangement of the frequencies of echo signals and of a heterodyne with correct and "image" tuning of the heterodyne is shown in figure 2. The tuning of a heterodyne in which the heterodyne in a receiver with an assigned index is tuned to a frequency corresponding to a receiver with another index is termed "image". For example, if a receiver has the index "N", tuning the heterodyne to the frequency f'_r will be "image".

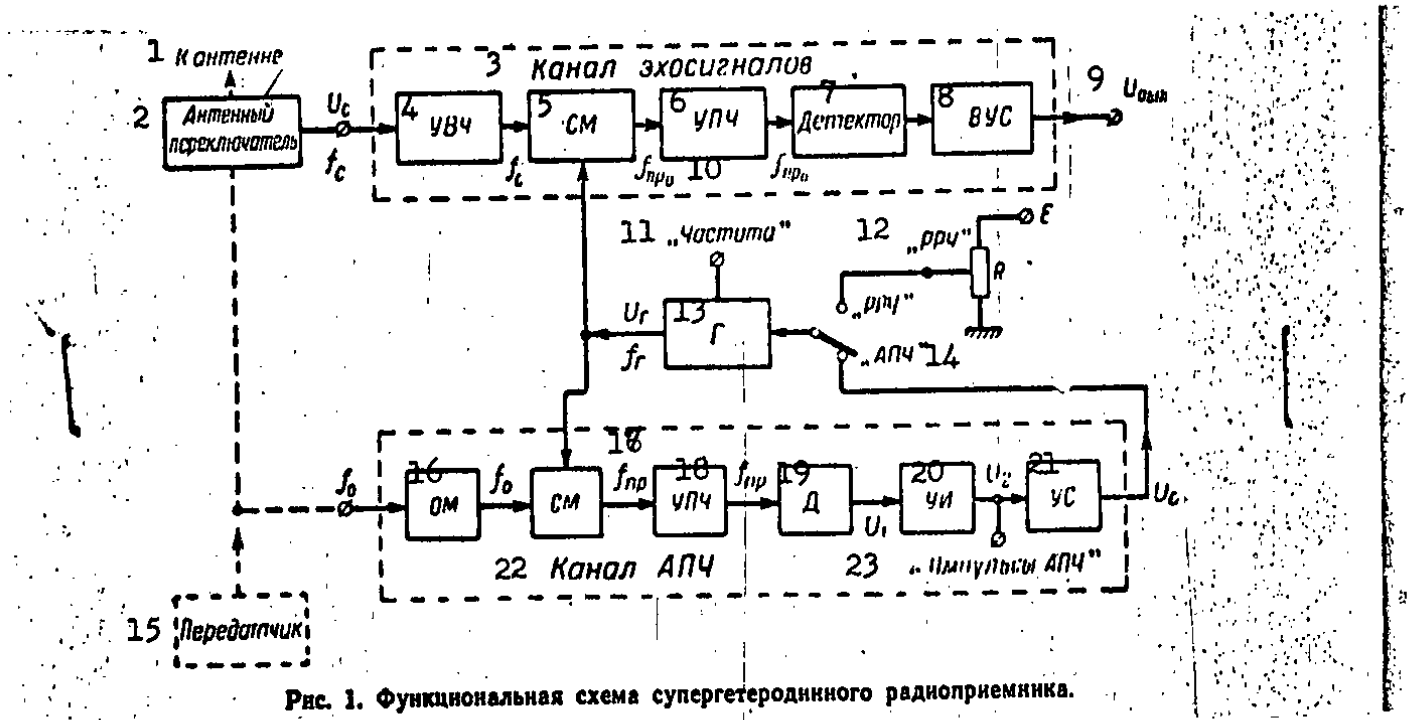


Рис. 1. Функциональная схема супергетеродинного радиоприемника.

Figure 1. The functional circuit of a superheterodyne radio receiver.

1. to antenna
2. antenna switch
3. echo signal channel
4. r-f amplifier
5. mixer
6. i-f amplifier
7. detector
8. VUS [auxiliary amplifier circuit?]
9. Uout
10. fint. fixed
11. "frequency"
12. "manual frequency tuning"
13. heterodyne
14. AFC
15. transmitter
16. power attenuator
17. fint
18. i-f amplifier
19. discriminator
20. impulse amplifier
21. control circuit
22. AFC channel
23. AFC pulses

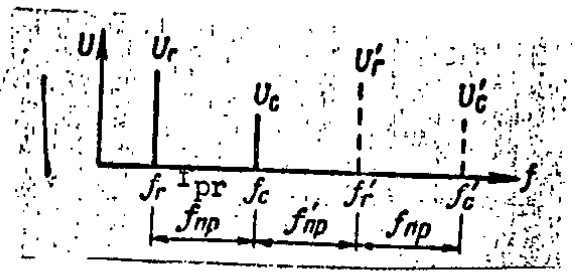


Figure 2. The mutual arrangement of the frequencies of echo signals and of a heterodyne with correct and "image" tuning of the heterodyne.

With manual receiver tuning (RRCh), heterodyne "image" tuning can lead to the formation of intermediate frequencies for extraneous radio signals, for example in a receiver with the index "N" to radio signals with the frequency f'_c. This makes observation of the effective signals difficult or impossible due to the background noise of the extraneous signals. If automatic frequency control (APCh) is used, heterodyne "image" tuning will be inexact. In both cases, receiver sensitivity is deteriorated which finally leads to essential deterioration of the basic technical characteristics of the set itself.

In radar sets, the echo signal frequency f_c is equal to the frequency f_o of the radio pulses produced by the transmitter (if the Doppler effect is not considered). This allows the frequency of the radio pulses produced by the transmitter to be used as a standard with heterodyne AFC.

In a superheterodyne receiver, the intermediate frequency amplifier (UPCh) of the echo signal channel is usually tuned to a fixed frequency (f_{pr_o}). Therefore, the transmitter and heterodyne must have fully

determined nominal frequencies f_o and f_{go}, which differ by the value of the frequency f_{pr_o}. However in the process of radar set operation, a change in the originally established frequencies f_o and f_{go} is observed, which evokes a need for them to be adjusted. Constant adjustment of the heterodyne frequency under the transmitter frequency is more exactly executed by an heterodyne AFC circuit which is installed in the receiver.

This is how it occurs in practice. Radio pulses produced by the transmitter are supplied to the AFC channel input. The power attenuator (OM) decreases their power to a required intensity. Then they are fed to the mixer (SM). Here, at the same time, oscillations from the heterodyne (G) are supplied. As a result of the mixer operation, radio pulses of many frequencies are received at its outlet. The i-f amplifier amplifies according to voltage those radio pulses which have a frequency equal to the frequency of the tuning amplifier and suppresses radio pulses of other frequencies. The discriminator (D) transforms the radio pulses which are supplied to it into video pulses.

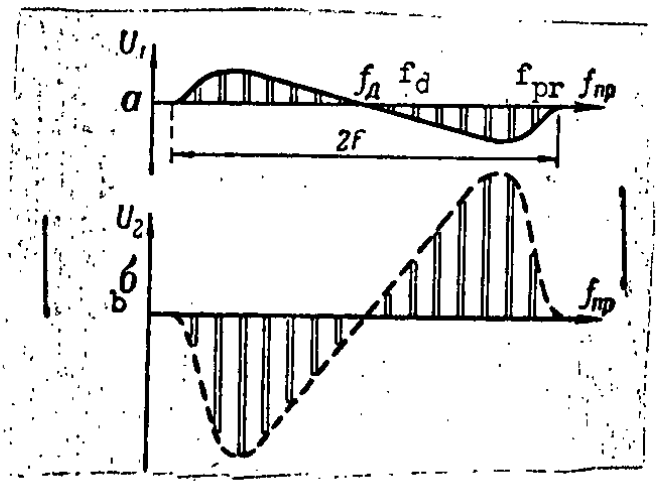


Figure 3. Discriminator and pulse amplifier characteristics.

The amplitude frequency characteristic of a discriminator is shown in figure 3. It should be noted that the intensity and polarity of output video pulses depend on the intensity and sign of radio pulse input frequency swing relative to the discriminator tuning frequency f_d. The output video pulses are then amplified according to voltage by the one-stage

impulse amplifier (UI) which changes their polarity at the same time (figure 3b). Then the video pulses go to the control circuit (US) which controls heterodyne oscillation frequency.

The control circuit has two operation regimes. The first, which is called the search regime, is characterized by the independent change of the circuit output voltage U_o within comparitively wide limits (figure 4a). This evokes the maximum possible heterodyne frequency change (figure 4b). In the given regime, the AFC channel carries out the search for the correct heterodyne frequency tuning.

The second regime, called the tracking regime, is characterized by a rather small change in the intensity of control circuit output voltage, in which f_g differs from transmitter frequency by the nominal value f_{pr_o}. Control circuit transfer from the search regime to the tracking regime occurs with the achievement of a certain intensity of amplitude by input positive video pulses.

Consider the operation of an AFC channel in a receiver with the index "N" ($f_{pr_o} = f_o - f_{g_o}$), with the heterodyne tuned to the "image" frequency f'_{g_o}. When the transmitter is switched off, the control circuit produces sawthooth voltage, which causes periodic changing of heterodyne frequency within a wide range. Thus he search for correct heterodyne frequency tuning is carried on.

Suppose that the transmitter is switched into operation at the determined time t' (figure 4). Then from moment t_1, voltage U_o takes the value where oscillation is started in the heterodyne. Since U_o is excessive at this time, the frequencies will have the values: f'_g is greater than f'_{g_o} and $f'_{pr} = f'_g - f_o$ greater than f'_{pr_o}. Video pulses U_2 of positive polarity appear at the impulse amplifier output from moment t_2 and their amplitude will be increased according to the amount of f'_{pr} frequency decrease. At moment t_3, the aplitude of the video pulses reaches the intensity where the regime of control circuit operation is changed from the search regime to the tracking regime, and its output voltage stops changing. With this, the heterodyne frequency will not be changed and its value will be equal to: $f'_{g3} \approx f'_g + F$, (2) where F is half of the transmission band of the highfrequency channel of the AFC channel.

Further, the AFC channel maintains the stable heterodyne "image" frequency f'_{g3}. With this, the intermediate frequency of the echo signals will be equal to:

In this case, the i-f echo signal frequency pulse spectrum is shifted in relation to the i-f amplifier characteristic frequency (figure 5), which leads to a decrease of receiver sensitivity, to distortion of amplified echo signal shape, and, as a result, to an essential deterioration of the most important technical characteristics of the radar set.

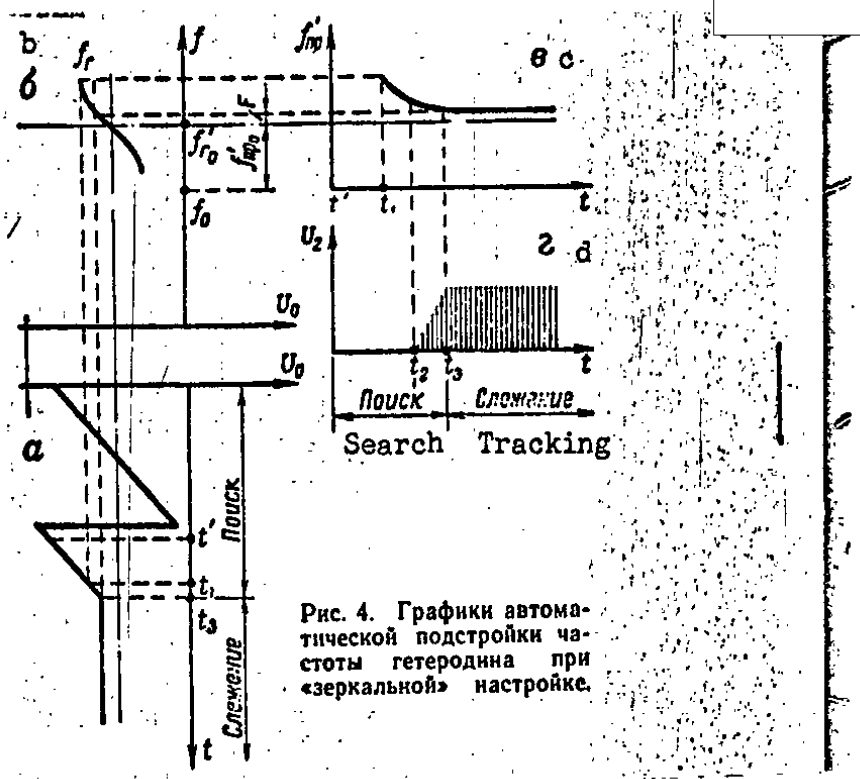
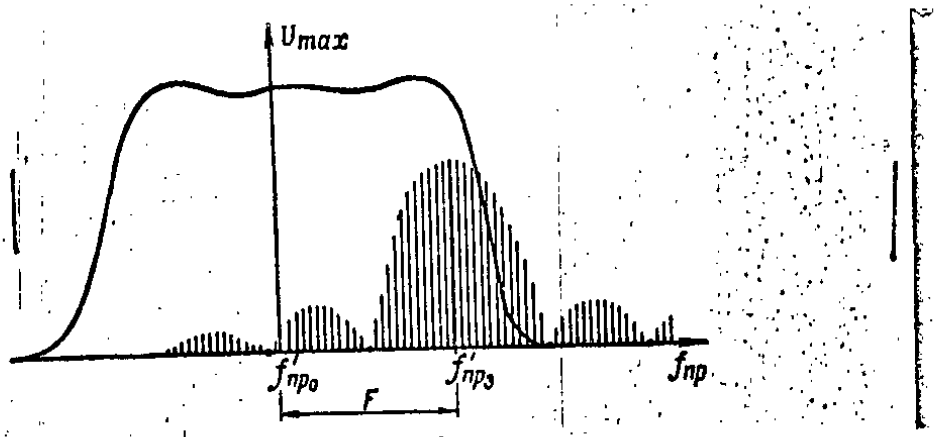


Рис. 4. Графики автоматической подстройки частоты гетеродина при «зеркальной» настройке.

Figure 4. Diagrams of heterodyne AFC with "image" tuning.

Figure 5. The mutual position of an i-f echo signal spectrum and an i-f amplifier frequency characteristic with heterodyne "image" tuning and AFC channel operation.



In heterodyne "image" tuning, a moment is possible when, with switching on the transmitter or the AFC channel, f'_{pr} is equal to f'_{pr_o}. Such a condition of the AFC channel is unstable. In the process of operation, the heterodyne frequency can be decreased insignificantly or the transmitter frequency can be increased. This leads to a decrease in the value f_{pr} and in the amplitude of impulse amplifier output video pulses, which in turn causes a decrease in the control circuit output voltage. With this, the heterodyne frequency and also the intermediate frequency are further decreased and the control circuit changes over from the tracking regime to the search regime. The change back to the search regime occurs at that moment when the heterodyne frequency takes the value:

$$f'_{g_3} \approx f'_{g_o} + F$$

After mechanical adjustment or overhaul, a check must be made in the heterodyne or transmitter to see that it is not tuned to the "image" frequency. In practice, this check can be accomplished in two ways. The first is to measure the radio transmitter frequency f_o and the heterodyne frequency f_{g_o} with a frequency meter (wave meter) while the heterodyne frequency is controlled by the AFC channel. After the measurements are made, it must be established whether the measured frequencies f_o and f_{g_o} correspond to the established receiver index. The second is to put the heterodyne in the manual frequency control regime to determine the influence of the f_g relationship in various positions of the manual frequency control adjustment mechanism. Output impulse amplifier voltage is supplied to the oscillograph input. Then, by gradually adjusting the manual frequency control, f_g is changed from its greatest value to its smallest. If, by this, negative video pulses are observed on the oscillograph screen at the beginning, and positive video pulses later; the heterodyne is correctly tuned. If not, it is tuned to the "image" frequency and must be changed by adjustment with the heterodyne frequency mechanical tuning mechanisms. After the heterodyne is checked, it is switched into the AFC channel.

Finally, notice that in heterodyne "image" tuning by the AFC channel, the frequency f_{pr_3} can be located in the same band as the frequencies which are normally amplified by the i-f amplifier of the echo signal channel. Then by measuring the sensitivity of the radio receiver with a standard signal generator, the same result can be achieved concerning the correct tuning of the heterodyne frequency (figure 5). Measuring the sensitivity by using oscillations with a wide spectrum, for example those produced by an unstable noise generator [shumovoy generator] gives the deterioration of receiver sensitivity as a result.

Maintaining Airfields in Excellent Condition -- by Engr-Capt V. V. PERVUKHIN (Pages 62-63)

Abstract:

Discusses methods for keeping airfields in operation in all weather conditions.

Cold-Cathode Tubes -- by Engr-Lt Col N. P. SUPRYAGA (Pages 64-67)

Text:

The acceptance and adoption of gas-discharge tubes with cold cathodes which has lately accurred is truly a technical revolution in the realm of electronics. In comparison with ordinary electron tubes, they are more economical and are more easily produced. A typical cold-cathode tube, for example a MTKh-90 tube, has only 6 parts, while a similar electron tube has from 60 to 90 parts. If the price of a typical electron tube is from 1 to 2 rubles, the cost of a mass-produced cold-cathode tube does not exceed 10 kopecks. There is also a great difference in the life of these tubes. A MTKh-90 tube will last for 100,000 service hours, but an electron tube will only last from 500 to 1,000 hours.

But this does not exhaust the advantages of cold-cathode tubes. They are distinguished by their readiness for instantaneous operation, great temperature range, and capability to operate in conditions of radioactive emissions. They conduct large pulse flows and are self-signalling by their luminescence. They also have stable properties, accept a power supply from alternating current circuits without transformers, are highly vibration-proof, etc.

A contemporary gas-filled tube with a cold cathode is constructed of a glass or metal envelope which is filled with a rarefied gas (usually with neon with the addition of another inert gas). The electrodes which are located in the envelope are produced from uncontaminated metal or are covered with activating matter. The most simple is the two-electrode neon tube. However the three-electrode tube is most widely used. The control electrode (grid) can be mounted in them on either side of the cathode or anode since they are not controlled by voltage, but usually by current.

Although cold-cathode tubes are significantly more simple in radio-electronic construction, the physical processes which occur in them are much more complex. To clarify the principles of their operation, let us consider what occurs when an electric current passes through the gas.

These phenomena are very different from those which occur with the passage of a current through a solid conductor or a liquid electrolyte. A difference in gas illumination can be observed here, from being weak and hardly noticeable to a dazzling brightness, and an acoustical effect and a specific chemical reaction can be distinguished, all of which are absent under normal conditions. Also, the electric current which is passing through the gas has its own laws. Ohms laws is valid in most cases for current which is passing through a solid or liquid body: with other conditions being equal, the force of the current is directly proportional to the difference of potential which is attributed to the given conducting body. In other words, with constant temperature and chemical composition of a body, its specific conductance and resistance remain constant. For currents, which are flowing through gases, this last aspect is valid only for individual cases. The electric conductance of a gas is not constant and depends on external influences or on the force of the current which is flowing through the gas. It sometimes depends also on the course of forerunning processes, for example on previous current forces. This dependence between current and voltage in a gas is not single valued and is often expressed by what is termed the falling volt-ampere characteristic.

If the gas were fully protected for external influences, it would be at low temperatures as ideal an insulator as a high vacuum. However, usually, the gas in a tube is permeated by X-ray, radioactive, or cosmic rays which cause electron emission amplification from the electrode surface. All of the processes which influence a gas from without and transmit electric conductance to it are called "external ionizers".

According to the amount of the difference of the potentials between the electrodes of a gas-filled container, the current influenced by such an external ionizer increases according to Ohm's law until it reaches saturation when it again gradually increases. With a certain difference of potentials, the phenomenon acquires new qualities: with small external circuit resistance, the current instantaneously grows to a very large intensity, the gas is illuminated, and the electrodes are heated. Such a phenomenon is called "gas discharge ignition" or "gas clearance disruption". It should be noted that after disruption, the charge is not stopped even if the influence of the external ionizer is eliminated. In this case the discharge becomes "independent". With a voltage smaller than ignation voltage, the discharge is stopped with the influence of the external ionizer and is then called "dependent discharge". Therefore, the term "transition of discharge from dependent to independent" is used to describe further discharge ignition. Dependent discharge which conforms to the beginning part of the volt-ampere characteristic which includes the realm of saturation current

is called "silent dependent discharge", but the discharge which conforms to the increasing part of the curve, 1 to 2 (Figure 1) is called "dependent Townsend discharge" (named after the scholar Townsend who was the author of the first quantitative theory of gas discharge).

If the gas pressure is not great and the external circuit resistance is small, what is called "glow-discharge" will take place with independent discharge ignition. It is characterized by the unique arrangement and alteration of illuminated and dark sections of the discharge interval, a comparitively small current density, and the presence of small regions with large drops of potential (hundreds of volts) around the cathode. The temperature of the cathode with this discharge is not great. However, if in glow-discharge, the current strength is gradually increased, decreasing external circuit resistance; the intensity of gas illumination and the cathode temperature will be gradually increased. In this, the volt-ampere characteristic will take on the aspect of a first falling then climbing curve.

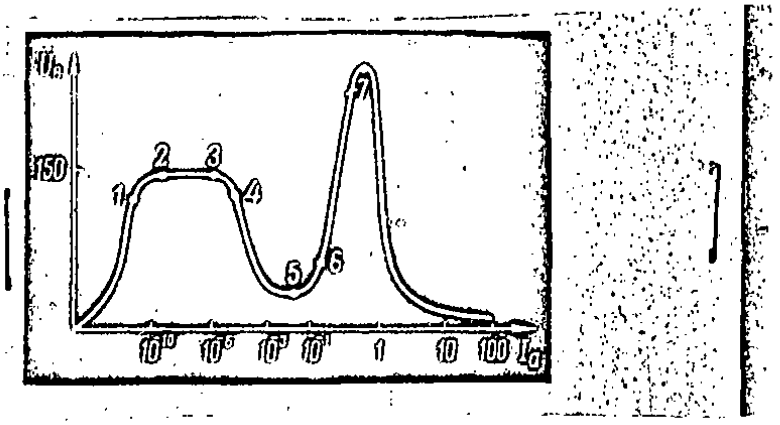


Figure 1.

With further increase of current strength, new phenomena occur: the current is again increased by jumps, the voltage passing through the discharge interval is sharply decreased, illuminated discharge segments are reorganized, the cathode is brightly illuminated, and an "arc discharge" with falling volt-ampere characteristics occurs.

Thus each discharge, no matter how great the accompanying current in its final stationary condition, is a Townsend discharge at the moment of ignition. Developing step by step, the discharge changes from one stage to another: from Townsend to glow, from flow to arc. The discharge will take on a corresponding aspect depending on the resistance put into the external circuit.

With a gas pressure equal to atmospheric, a comparatively large distance between electrodes, a high voltage, but a small power supply; a discontinuous spark discharge occurs at the moment of disruption.

It is characterized by the current traveling through the gas in a zigzag, narrow, and illuminated channel. When the discharge becomes independent, what is called a "corona discharge" with a small current force occurs. It is accompanied by illumination around the electrode with a small radius of curvature. Only with a significant increase of the difference between the potentials between the electrodes will there be observed a "spark disruption", but with a sufficient power supply the corona discharge changes to an arc discharge.

The complexity of the discharge processes, the phenomena of transfer to "independent" discharge, and to a great degree the complex change of the volt-ampere characteristic which occur when a current flows through a gas evoke the possibility for using gas-filled tubes for many varied purposes: to change alternating current to direct current and on the other hand to generate oscillations, etc.

Free electrons which appear in small quantities in the gas, under the influence of the external ionizer and the electric field, acquire kinetic energy which, with determined difference of potentials between the electrodes, is sufficient for ionization of gas molecules. The electrons which have appeared as a result of the ionization of the gas are accelerated by the electric field and cause new stages of ionization. In this manner, the process develops in the manner of an avalanche. The concentration of ions and free electrons in the gas depends on the strength of the current and the field in discharge. This circumstance is the reason for both the non-validity of Ohm's law in gases and the complex aspect of the volt-ampere characteristic (Figure 1).

The following parts of the curve are shown in the figure: 2 to 3, corresponding to the Townsend discharge; 3 to 4, discharge change over stage; 4 to 7, glow discharge; and after point 7, transfer to arc discharge begins. The presence of the drop in the characteristic curve, which corresponds to negative resistance, allows cold-cathode tubes to be used both as oscillation generators and for amplification of voltage and current pulses.

It should be noted that work carried out in 1947 for the perfection of gas-filled tubes with cold cathode showed that it was possible to use these tube widely in pulse equipment. At the present time a method has been worked out for autostabilization of their operation, increasing their sensitivity, and decreasing their inertness. The substance of

this method is that an independent silent discharge is created in the starting electrode circuit with the current not exceeding several microamperes. Anodic voltage is supplied to the starting electrode for this and a large resistance of from 10 to 100 megohms (Figure 2) is put into the external circuit. Thanks to this regime, a large initial ionization is created which sharply decreases the inertness of tube operation. Also, an ignition voltage is automatically supplied to the control electrode which provides the greatest tube sensitivity. Finally, such a regime provides stability of tube operation with unstable ignition voltage and power supply voltage oscillation, since voltage at the control electrode automatically follows all of the changes of ignition voltage and does not depend very much on changes of intensity of limiting resistance and initial current.

Another regime of cold-cathode operation, a tetrode regime, has been described in foreign literature. In this regime, initial ionization is created by means of an auxiliary discharge from an additional fourth electrode and a small bias which is slightly smaller than ignition voltage is supplied to the control electrode. However, as evaluated by foreign specialists, the tetrode regime does not have essential advantages over the triode since it requires an increase in the number of parts in the circuit. Also, when this regime is used, instability of tube parameters and bias voltage strongly influence sensitivity, thereby requiring larger voltage to start the tube.

In the past few years many improvements have been made in cold-cathode tubes. For example, activated cathodes have been accepted which have constant electron emission which plays an important role in the ignition process since this eliminates time ambiguity in tube operation. Also, a new method for decreasing de-ionization time has been developed.

The basic types of cold-cathode tubes which are produced by our industry are: TKh-1, TKh-2, TKh-3B, TKh-4B, MTKh-90, and others. The characteristics of these tubes is briefly described below.

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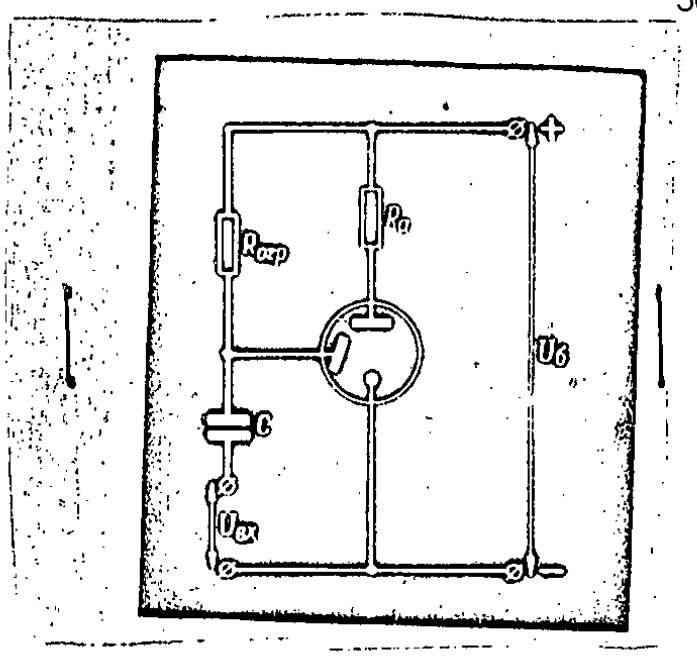

Figure 2.

The TKh-1 tube has significant dimensions, a large de-ionization time, and also a large delay in operation time. Relaxation is possible in the control electrode circuit thereby making difficult the establishment of initial silent discharge. Ignition flow is not greater than 5 microamperes with an anodic voltage of 130 volts. These shortcomings decrease the value of the tube, but it has an advantage in its long service life. With 10 milliampere currents its life is 10,000 hours.

The TKh-2 tube is of higher perfection. It is related to the bantam tube series. It sustains reverse voltage up to 2,800 volts with large direct current which is very important in high-power relay operation.

TKh-3B and TKh-4B tubes are of almost identical construction. They operate in the tetrode regime. In spite of their increased stability, a pulse amplitude of at least 40 volts with a duration of 10 microseconds is required to start them.

Positive properties of the TKh-4B tube are that it has a smaller de-ionization time than any other comparitive mass-produced tube and that it can operate in the triode regime with connected grids. A short-coming is its short service life which is a consequency of the operating part of the cathode being small in relation to its total surface. Also, its uncontaminated metal cathode (molybdenum) has a negative influence on the service life of the tube since the cathode is more strongly disintegrated from a large voltage drop.

The MTKh-90 tube is a low-voltage, small size tube with an activated cathode. It has a cylindrical envelope with a flat top surface. This is very important since such construction allows the envelope to be exposed on the front panel of an instrument which is very useful for checking the operation regime of the tube (by its brightness), and also permits final readings to be taken from it. It is very inexpensive and requires only 0.5 to 0.6 grams of metal for its construction. It contains 4 to 5 times fewer parts than a TKh-3B or TKh-4B tube. Its value is that with a very small current, if it becomes necessary, it can in 10 microseconds emit a pulse current of up to 1,000 amperes. The MTKh-90 tube is used in many logical circuits, in delay circuits, as a time relay, etc.

Cold-cathode tubes have already found wide usage in various conversion instruments, for example in the BK-3 and PK-10B which are used for the detection of radioactive emissions and the measurement of their intensity, in pulse counters, and in other radar equipment. Many of these tubes are used in automatic equipment where the relay properties of cold cathode tubes and their self-reserving and self signaling capabilities can be fully realized. The BMA-50 fast acting differential analyzer is constructed with these tubes. It permits automation of measurement of various quantities and processes which are expressed by a large number of pulses of diverse amplitudes.

However, the greatest use of cold-cathode tubes is in electronic computing equipment. Thus, for example, MTKh-90 tubes operate as registers, triggers, and key circuits in the "Ural" machine. There are over four times as many of this type tube in this machine as there are electric vacuum devices. The magnetic tape control block of the modernized memory apparatus of the "Strela" machine has 184 cold-cathode tubes.

This is far from being a complete listing of all of the instruments and devices which use cold-cathode tubes. There can be no doubt that their number will increase with every year of development.

Electronic Countermeasure Equipment on Aircraft and Space Vehicles -- by Engr-Capt 2d Rank Yu. G. STEPANOV and Capt 3d Rank (Res) D. Z. LEVIN, Candidate of Naval Sciences (Pages 68-70)

Text:

(According to foreign press materials)

A large amount of attention has been paid in the last few years among the armed forces of the imperialist countries to perfecting new means of electronic countermeasures (ECM) [RPD] and to developing methods for their use. The USA spends approximately 600 million dollars per year on this matter alone.[1] It is characteristic that a large part of these funds go for aircraft equipment and for ECM means for rockets and satellites. Concerning the preparation of what is in truth a "radio war", it is a fact that over 70 American industrial firms, many universities, scientific research centers, and army, navy, and air force test ranges are all occupied with the development of equipment for ECM systems.[2]

The most intensive development of ECM systems is for strategic bombers. One such system, which is called "Electronic Shield" and is intended for the B-58 bomber, is a lightweight system composed of three basic components: a special panoramic radar signal receiver, interference transmitters, and devices for scattering dipole reflectors. The system can be controlled either automatically or manually. An aircraft, armed with such a system for interference with rocket defense [PRO] and air defense [PVO] radar, can provide, as stated in the foreign press, safe penetration by bomber groups through the air defense boundaries of an enemy and can protect them from being attacked by guided missiles.

The American firm, Sperry Rand, has developed an ECM system called the AN/ALQ-27 for the B-52 bomber and the Westinghouse firm has developed an ECM system for the B-70 bomber, which will operate on frequencies not covered by the AN/ALQ-27. Complex ECM systems have been proposed to arm naval aircraft. An important part of such a system will be means for active interference.

Recently only magnetrons were used in interference transmitters, but now along with magnetrons; traveling wave tubes [LBV], carcinotrons [LOV], and other electric vacuum instruments are widely used. For example, in the ECM system of a B-52 bomber, powerful "O" type traveling wave tubes are used which enable enemy radar to be suppressed within a wide range of frequencies.

The Sperry Gyroscope firm has developed a traveling wave tube with a liquid cooled spiral. This has allowed the operation power of the tube to be increased from 50 watts to 3,000 watts in the 3 to 6 centimeter range, which leads to a significant increase in the effectiveness of the radar countermeasure system.

There is information available that carcinotron interference transmitters are employed on the English bombers Victor and Vulcan B.

Parameters of existing tubes for ECM equipment are given in the included table.

Basic Parameters for Tubes of ECM Equipment

Tube Type	Operating Frequencies (cm)	Retuning (Character and Range)	Power	
			Pulse	Continuous
Magnetron	60-0.3	Mechanical 15% from basic freq	From 1 Mw to 5 Mw at 10 cm	From 1 Mw to 10 kw 30 cm
Amplitron	150-3	---	200 kw to 8 Mw	1 w to 20 kw
"O" type Traveling Wave Tube	100-1	---	From 10 kw at 10 cm. Development to 1 Mw in 10 cm range	From 1 Mw to 100 w at 10 cm
"M" type Traveling Wave Tube	100-0.81	---	To 8 Mw at 25 cm	6 kw at 25 cm (Development)
"O" type Carcinotron	100-1	Electronic to 3:1	---	1 Mw to 1 w. 100 w at 10 cm (Development)
"M" type Carcinotron	100-2	Electronic 1.5:1	To 150 kw at 10 cm	10 Mw to 1 kw at 10 cm
"O" type Boosting Carcinotron	100-1	Electronic 2:1	---	Milliwatts
"M" type Boosting Carcinotron	100-1	Electronic 1.5:1	---	10 Mw to 1 kw at 10 cm

The American firm Litton has developed a powerful tube called the "barratron" to be used in radio interference equipment to generate incoherent white noise. Its advantage over the magnetron is that it creates a wider spectrum of interference and at a lighter level. The tube is produced in two variants: with fixed tuning and with continuous retuning in relation to frequency. The first variant provides sufficient jamming interference power in the whole spectrum to use the tube in aircraft interference transmitters. The firm manufactures 18 types of barratrons with hydraulic and mechanical tuning to cover the frequency spectrum from the ten-meter band to the shortwave portion of the hundred-meter band.[3]

Special aircraft rockets filled with dipole reflectors are produced in the USA. These rockets allow dipoles to be thrown out ahead, behind, and above a flying aircraft to create dummy radar targets around it.

Surface-to-air, air-to-surface, and air-to-air guided missiles occupy an important place in ECM. For example, special rockets to act as false "decoy" targets and also rockets with passive guidance systems, intended to be fired at operating radar, are being manufactured in the USA.

On the basis of data achieved in the operation of the Corvus rocket with its passive guidance, the firm, Texas Instruments, under Naval contract, is developing an air-to-ground antiradar rocket called the Shrike. It will be carried by carrier-based fighters and fighter-bombers.[4]

To neutralize enemy radar while carrying out offensive troop action by providing what is called "electronic cover", US armed forces propose to make wide use of single-action active interference means. There will be in the form of shells and rockets with interference transmitters in place of war heads.

American specialists believe that ECM will increase sharply in importance with the growth of military use of space. This is stipulated, in their opinion, by the fact that in spite of the great advantages of spacecraft over piloted aircraft, space vehicles cannot overcome enemy air and space defenses without difficulty unless proper measures are taken to neutralize early warning radar.

It is pointed out in the press that concrete methods of ECM depend on the construction and design of space equipment of the future. It is believed that the power of interference stations of space vehicles necessary to neutralize radar operating against space ships will be of the same order as the power of interference stations which are used for neutralizing radar acting against contemporary aircraft.

It is pointed out that for countermeasures against space radar defenses, space equipment can be equipped with automatic transmitters for barrage and spot noise jamming and also with interference response equipment. It can be derived from this that active means of interference on space equipment will be approximately the same as that employed on piloted aircraft.

It is very widely proposed to use ECM means on reconnaissance satellites. They will then be given the assignment, in addition to strategic and tactical reconnaissance, to execute "radioelectronic warfare." Thus it is proposed to equip a whole system of reconnaissance satellites with means for ECM by 1965.

The high sensitivity of reception devices used in space defence early warning systems and the wide range of frequencies in which they operate having been taken into account, it has been proposed in foreign countries that, to protect space vehicles, interference be created against enemy space defense systems at a very great distance from the surface of the Earth by using the phenomenon of tropospheric and ionospheric scattering of radio waves. This is considered as a prospective development to protect space vehicles which travel in the airless reaches of space from radar defenses.

In the opinion of foreign specialists, a most effective means of ECM will be a camouflaging cloud of light radiowave reflecting objects (fiberglass, foil, etc.) ejected from an artificial Earth satellite [ISZ] after it has gone into orbit. Having approximately the same speed as the satellite, these particles will move around it at a certain distance to make very difficult the determination of the orbit of the satellite by enemy radar.

Such a means of protection from enemy radar has been proposed to be widely used with intercontinental ballistic missiles (ICBM) [MBR]. But a certain shortcoming is noted here. It consists of the following. When an ICBM warhead and its encircling cloud of passive reflectors begin to reenter the atmosphere of the Earth, the basic mass of the cloud of particles inevitibly falls behind the ICBM war head because being much lighter and smaller they are more affected by air resistance than is the warhead. It is believed that this shortcoming can be overcome by including heavier particles in the cloud. They will follow the warhead closely enough for a long enough period to make interception of the warhead very difficult.

In July 1961 from the US testing grounds at Canaveral, a test launch of a Titan rocket was carried out. The Titan was equipped with apparatus to eject false "decoy" targets. The rocket which was equipped with a dummy atomic charge flew 8,000 kilometers and fell in a southern region of the Atlantic Ocean. After separation of the booster, its war head

ejected six false targets and after reentry into the atmosphere it ejected four more. All of the decoys had balloons in their noses which were automatically inflated after ejection and caused an increase in the number of images received on radar screens, thereby masking the true dimensions and position of the target.

This is far from all of the data on work being carried out in foreign countries in the realm of electronic counter measures.

1. Missiles and Rockets, March, 1961
2. Space Aeronautics, April, 1959
3. Space Aeronautics, April, 1960
4. Interavia Air Letter, No 4853, 1961
5. Missiles and Rockets, No 13, 1961

Super-Hawk in US Antimissile Defense (Page 70)

Abstract:

Reportedly based on material from Missiles and Rockets, December 1962 announces that the US is considering development of a Super-Hawk antimissile system based on the existing Hawk antiaircraft missile system and states that the system could be effective against submarine-launched rockets.

ROCKET DEFENSE

Development of Means for Detection and Tracking of Space Targets -- by Engr-Col Ye. K. BRAGIN and Maj A. G. KUBAREV (Pages 71-74)

Abstract:

Based on material from the foreign press, discusses projected developments and uses of SPADAT; BNEWS; DSJF; Minitrack; Advent; Hay Stack; Synchrolink; Ultracomm; Mistram; and Poesid systems; and AN/FPS-16, AN/FPQ-6, and TPQ-18 radars. Foreign press sources cited in the article included: Aviation Week, January 1961 and July 1962; Missiles and Rockets, May 1961 and November 1962; Electronics, February and September 1961; and Interavia Air Letter, November 1960.

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FROM THE HISTORY OF PVO TROOPS

When Was the First Domestic Radar Invented? -- by Maj Gen (Ret) P. Ye. KHOROSHILOV (Pages 75-78)

Abstract:

Traces the events and discoveries leading to the invention of radar in the USSR in an attempt to prove that radar was invented and in operation in 1934, approximately five years prior to any western claims for inventing radar. The author reportedly took part in phases of the radar invention process.

REVIEWS AND BIBLIOGRAPHY

What Will Appear on the Book Shelf This Year (Pages 79-80)

Abstract:

Briefly reviews or mentions the following 1963 publications of Voyenizdat:

Voyenno-teoreticheskoye naslediye V. I. Lenina (The Military Theoretical Heritage of V. I. Lenin) by a group of unnamed authors

Armiya obshchenarodnogo gosudarstva (The Army of the People's Government) by a group of unnamed authors

Kommunisticheskoye vospitaniye sovetskikh voinov (The Communist Training of Soviet Soldiers) by a group of unnamed authors

Voyennaya ekonomika (Military Economics) by a group of unnamed authors

O sovetskoy voyennoy nauke (Soviet Military Science) by a group of unnamed authors

Pentagon (The Pentagon) by a group of unnamed authors [against imperialist military policies]

Zapadnaya Germaniya i NATO (West Germany and NATO) by L. P. MAKAROV and N. F. GOLOVANOV

Psikhologicheskaya voyna-oruzhiye imperialistov (Psychological Warfare -- An Imperialist Weapon) by M. P. GUSEV and T. K. BELASHCHENKO

Partiyno-politicheskaya rabota v Sovetskikh Vooruzhennykh Silakh (Party-Political Work in the Soviet Armed Forces) [training aid for commanders in troop training, authors not named]

Osnovy voyennoy pedagogiki i psikhologii (Fundamentals of Military Pedagogy and Psychology) [to aid commanders in troop training, authors not named]

Pedagogika (Pedagogy) by A. G. BAZANOV

Psikhologiya (Psychology) by G. D. LUKOV and K. K. PLATONOV

Avtoritet komandira (The Authority of the Commander), author not named

Leytenanty nachinayut sluzhbu (Lieutenants Begin Service) author not named

Stanovleniye letchika (To Become a Pilot) by Maj Gen Avn V. A. KUZNETSOVa

Tsentrobalt (Selected Works of V. K. Blyukher, M. N. Tukhachevskiy, and S. S. Kamenev) by N. F. IZMAYLOV and A. S. PUKHOV

Five pamphlets of a series entitled Geroicheskoye proshloye nashey Rodiny (The Heroic Past of Our Native Land)

Sovetskiy soldat na Balkanakh (The Soviet Soldier in the Balkans) by Mar SU S. S. BIRYUZOV

Predstavitel' Stavki (Representative for Headquarters) by Chief Mar Arty N. N. VORONOV

Krasnyye strely (Red Arrows) by Col S. F. SHUTOV, Twice HSU

Vysoty i dali (Heights and Distances) by V. S. GRIZADUBOVA, HSU

Vsegda soldat (Always a Soldier) by former fighter pilot S. P. SABUROV

Aviatsionnyy spravochnik dlya letchikov i shturmanov (Aviation Reference Manual for Pilots and Navigator-Bombardiers) edited by Maj Gen Avn V. M. LAVSKIY

Raketonosnaya aviatsiya (Rocket Armed Aviation) by Col Gen Engr-Tech Serv A. N. PONOMAREV [technically oriented]

Raketnoye oruzhiye na samolete (Aircraft Rocket Armament) by N. G. KON'KOV [technical]

Avtomatizatsiya sistem PVO (Automation of Air Defense Systems) by Engr-Capt G. P. BUBNOV [possibly based on foreign press material]

Tekhnika upravleniya raketami i issledovaniya kosmicheskogo prostranstva (Rocket Guidance Equipment and the Investigation of Space) by M. HOBBS [translation]

Ballisticheskiye rakety dal'nego deystviya (Long Range Ballistic Rockets) by E. BURGESS [translation]

Konstruirovaniye upravlyayemykh snaryadov (Guided Missile Designs) by A. PACKETT and S. RAMO [translation]

Radioelektronnaya voyna (Radioelectronic Warfare) by R. SHLESINGER [translation]

Matematicheskiye metody issledovaniya operatsiy (Mathematical Methods of Research) by T. SAATI [translation]

Perekhvatchiki (Interceptors) by L. A. EKONOMOV

Startuyut istrebiteli (Fighter Alert) by Lt Col I. F. GREBENYUK

Rakety ne molchat (The Rockets Are Not Silent) by N. A. GORBACHEV