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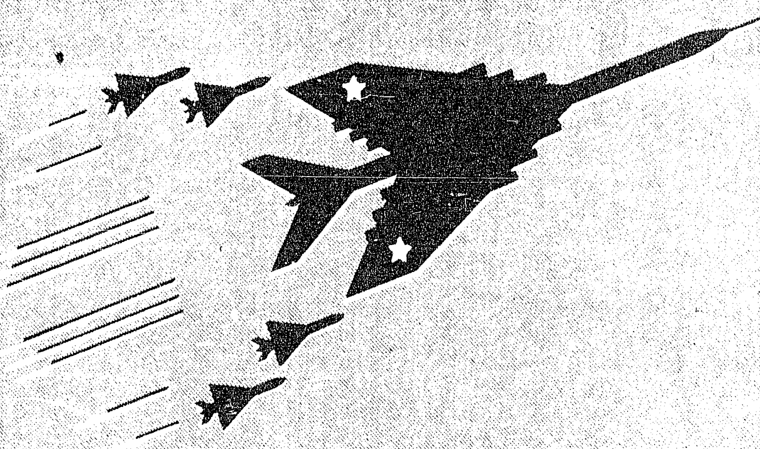
TRANSLATION

HERALD OF THE AIR FLEET



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EXPLANATORY NOTE

This publication is a translation of Herald of the Air Fleet, (Vestnik Vozdushnogo Flota) a monthly journal of the Soviet Air Force published by the Military Publishing House, Ministry of Defense, USSR.

Every effort has been made to provide as accurate a translation as practicable. Soviet propaganda has not been deleted, as it is felt that such deletion could reduce the value of the translation to some portion of the intelligence community. Political and technical phraseology of the original text has been adhered to in order to avoid possible distortion of information.

Users and evaluators of this translation who note technical inaccuracies or have comments or suggestions are urged to submit them to: Commander, Air Technical Intelligence Center, Attention: AFCIN-4B, Wright-Patterson Air Force Base, Ohio.

AIR TECHNICAL INTELLIGENCE TRANSLATION

(TITLE UNCLASSIFIED)

HERALD OF THE AIR FLEET

(Vestnik Vozdushnogo Flota)

3

1958

AIR TECHNICAL INTELLIGENCE CENTER
WRIGHT-PATTERSON AIR FORCE BASE
OHIO

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FROM THE EDITOR'S MAIL

REVIEW AND BIBLIOGRAPHY

GREETINGS FROM THE CENTRAL COMMITTEE OF THE CPSU, FROM THE PRESIDIUM OF THE SUPREME SOVIET OF THE USSR, AND FROM THE COUNCIL OF MINISTERS OF THE USSR

To the Men of the Valiant Armed Forces of the Soviet Union

The Central Committee of the Communist Party of the Soviet Union, the Presidium of the Supreme Soviet of the USSR, and the Council of Ministers of the USSR warmly salute and cordially congratulate the soldiers and sailors, sergeants and first sergeants, officers, generals and admirals of the Armed Forces of the USSR, and the former military men now in the reserves and in retirement, upon the occasion of a nation-wide celebration — the Fortieth Anniversary of the Soviet Army and Navy.

The Soviet Army and Navy, created and nurtured by the Communist Party under the leadership of the great Lenin, for the defense of the achievements of the October Revolution, have carried out with honor their military duty to the Socialist Motherland. Relying upon the mighty power of the Socialist order and upon the wholehearted support and inexhaustible energy of the masses of the people, our Armed Forces defended their beloved Fatherland in fierce battles against threatened enslavement by the imperialist beasts of prey and helped the nations of Europe free themselves from the Fascist yoke. The Soviet warriors displayed iron tenacity, and unyielding bravery and mass heroism in fierce battles against numerous enemies. The best sons of the workers and peasants, fighting under the combat banners of the Soviet Army and Navy, entered many brilliant pages in the heroic chronicle of the struggle and victories of our multinational people.

The Soviet people love their Army dearly, are proud of its combat glory, and piously revere the memory of their warrior-heroes who gave their lives in the struggle for the freedom and independence of our Motherland.

Surrounded by the love and constant concern of the people, the Party, and the Government, the Soviet Army and Navy have been turned into an invincible force of the Socialist State. In their combat ranks, splendid cadres of commanders and political workers have arisen who serve as an example of loyal service to the people and Party and who labor indefatigably to perfect the combat training of their personnel and to improve Party-political work in the units and on the ships. The Party organizations of the Army and Navy, steadily putting the policy of the Party into practice, are cementing the unity and solidarity of troop personnel around the Leninist Central Committee of the Communist Party and are mobilizing men at arms for the successful fulfillment of the tasks confronting the Armed Forces of the USSR.

The Communist Party and the Soviet Government, loyal to the peace-loving foreign policy of Lenin, struggle firmly and consistently to preserve and consolidate peace. At the same time, taking into account the present-day international situation and the policy of armament race and preparation for a new war being pursued by the imperialists, the Party and Government are untiringly seeing to the strengthening of the country's defense potential. The Armed Forces of the USSR now have at their disposal modern combat equipment and everything necessary for the reliable defense of their Motherland.

The Central Committee of the CPSU, the Presidium of the Supreme Soviet of the USSR, and the Council of Ministers of the USSR express their firm confidence that in the future as well the valiant warriors of our Armed Forces, boundlessly devoted to the Socialist Motherland and their people, will defend in a trustworthy manner the achievements of Great October against the encroachment of the imperialist aggressors, and will vigilantly stand on guard over the peaceful labor of Soviet men and women for the sake of the triumph of Communism.

Dear comrades! Companions in arms!

Be worthy of the high trust of the Soviet People, the Party, and the Government, who have assigned you to the defense of our hallowed borders and the state interests of our Motherland!

Master your modern combat equipment and weapons persistently, improve your military and political knowledge, intensify discipline and good organization in your ranks!

Strengthen your combat friendship with the soldiers of the countries of the Socialist camp who, shoulder to shoulder with our Army, stand guard over the peace and security of our peoples!

Piously preserve and multiply the combat traditions in which the history of our Armed Forces is so rich! Bear on high the honor and unfading glory of our combat banners!

Glory to the valiant Armed Forces of the Soviet Union!

Long live the great Soviet people — the builder of Communism!

Long live the Communist Party of the Soviet Union — the inspirer and organizer of all our victories!

The Central Committee of the Communist Party of the Soviet Union
The Presidium of the Supreme Soviet of the Union of the SSR
The Council of Ministers of the Union of the SSR

THE ROAD TO NEW VICTORIES FOR THE KOLKHOZ SYSTEM

The Communist Party of the Soviet Union and its Leninist Central Committee have elaborated an imposing program for the further development of Communism in our country. All Soviet people, with great enthusiasm, tenacity, and persistence, are striving to live up to the historic decisions made at the Twentieth Congress of the CPSU.

In recent years, under the leadership of the Communist Party, our people have attained outstanding success in the development of socialist industry and agriculture, in cultural development, and in raising the welfare of the working people. In the two years that have elapsed since the Twentieth Congress of the CPSU, the output of industrial production has increased by 22% and that of heavy industry by almost 24%, while the national income has risen by 18%. The reorganization of the national economy has been of exceptional importance in furthering the development of the socialist economy. It has contributed to the further development of creative initiative among the masses, to their participation in the management of production, and to efficiency and concreteness in the management of enterprises.

Simultaneously with the growth of industrial production in our country, problems bearing on the fundamental development of all branches of the rural economy are being successfully solved. On the basis of the resolutions adopted at the September Plenum of the Central Committee of the CPSU (1953), the Soviet people have succeeded in increasing considerably the production of grain, sugar beets, cotton, flax, potatoes, and vegetables. The lag in animal husbandry is being overcome. As a result of measures taken by the Central Committee of the Party the kolkhozes have become stronger organizationally and economically. The material and technical basis of kolkhozes, MTS [Machine-Tractor Stations], and state farms has also been strengthened.

The decisions made on 25-26 February 1958 at the Plenum of the Central Committee of the CPSU mark the most important stage in the building of Communism in our country, in the further growth of the socialist economy, and in the development of the kolkhoz system.

The February Plenum heard and discussed the report of the First Secretary of the Central Committee of the CPSU, Comrade N. S. Khrushchev, "On Further Development of the Kolkhoz System and Reorganization of Machine-Tractor Stations", and outlined practical measures for further strengthening and development of the kolkhozes.

The Plenum noted the outstanding success achieved in the past few years in the development of industry and agriculture. Socialist industry provides agriculture each year with more and more tractors, combines, and other agricultural machines.

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In the last four years alone the agriculture of our country received 908,000 tractors (in 15 hp units), 293,000 grain combines, 143,000 silage harvesting and corn harvesting combines, 467,000 trucks. The rural economy is now provided to a great extent with modern farming equipment. The Party has trained remarkable kolkhoz cadres. There are thousands of Communists doing supervisory work at MTS and kolkhozes, many of whom have come from industrial enterprises, and there are various agricultural experts with higher and intermediate specialized training.

All this has made it possible to raise kolkhozes to a higher level of development, to expand the communal organization at kolkhozes, to strengthen them economically, to increase agricultural production, and to raise considerably the income of the kolkhozes and the welfare of kolkhoz members.

The Plenum of the Central Committee of the CPSU has pointed out the exceptional role of the MTS in the building of kolkhozes, in equipping them with machinery, and in strengthening the unity of the working class and the peasants.

MTS are the most expedient form for the initial stage of kolkhoz building, the form by which the Government has helped the kolkhozes to develop and become strong. "The MTS", as is stated in the decision of the Plenum of the Central Committee of the CPSU, "was the great political and organizing force around which the peasants banded together into kolkhozes and became convinced of the advantages of large-scale mechanized agriculture. Technical progress in agriculture and its re-equipment on the basis of new technology, training of skilled cadres of mechanizers, and improvement in crop cultivation and animal husbandry were achieved through the MTS."

The MTS have played a great role in increasing the production of grain and other food products, as well as raw material for industry. Great is their organizing role in the fight against backwardness in different areas of agriculture.

The Communist Party and all the Soviet people value highly the exceptionally important role of the MTS in the building of kolkhozes and in the development of socialist agriculture. But this is not by any means to say that this particular form should be constant and applicable once and for all to all stages of the building of socialism and the development of our socialist agriculture.

Our Party has always followed and continues to follow the doctrine of Marxism-Leninism, the instructions of the great Lenin, that the organizational forms of administration in industry and agriculture cannot be given in their final form for all periods of historical development but must be perfected in accord with the changing situation to meet the demands of the given stage of development. Routine, conservatism, and a tendency to hang on to the old forms can only hinder our progress in building Communism.

The February Plenum of the Party's Central Committee, inspired by the creative spirit of Marxism-Leninism, adopted a resolution "On Further Development of the Kolkhoz System and Reorganization of Machine-Tractor Stations". The Plenum pointed out that now that the kolkhozes have become economically and organizationally strong the existing form of the production and technical servicing of the kolkhozes through MTS no longer corresponds to the needs of economic development or the needs of the development of the productive forces of agriculture, and that in many instances it is even beginning to impede further growth of the leading kolkhozes and to hamper the initiative of kolkhoz cadres and all kolkhoz members in utilizing more effectively the potentialities of kolkhoz production. A situation where two enterprises — kolkhoz and MTS — are conducting a single production process on the same land often leads to lack of personal responsibility in the organization of production, reduces the responsibility for increasing productivity, and gives rise to great and unnecessary expenditures to maintain a parallel administrative apparatus.

In the present period of the building of kolkhozes, the MTS have in many ways exhausted their functions. Life itself demands a change to new organizational forms, elimination of difficulties in the development of the kolkhoz system, creation of conditions for a greater flowering of the productive forces, and a rise in labor productivity. This is why the Plenum of the Party's Central Committee considers it desirable to change the existing order of production and technical servicing of the kolkhozes and to reorganize gradually the MTS in the interests of further growth of socialist agriculture and development of the kolkhoz system.

Considering that the majority of kolkhozes are economically strong and are now in a position to acquire and make more efficient use of tractors, combines, and other agricultural machines, the Plenum of the Central Committee of the CPSU considers it advisable to sell these machines directly to the kolkhozes. Having the necessary machinery at their disposal, kolkhozes will put them to more effective and productive use, which in turn will accelerate technical progress in agriculture, raise labor productivity, and permit a considerable increase in agricultural output. The sale of agricultural machines to kolkhozes and reorganization of the MTS will bring agricultural machine building closer to the needs and requirements of kolkhozes, will thereby increase the contact between industry and agriculture, and will have a favorable effect on the further strengthening and broadening of the union between the working class and the working peasant masses.

The resolution of the Plenum of the Central Committee of the CPSU and the propositions of Comrade N.S. Khrushchev's report "On Further Development of the Kolkhoz System and Reorganization of Machine-Tractor Stations" give a Marxist analysis and substantiation of the necessity for reorganizing the machine-tractor stations into repair and technical stations (RTS). They outline the ways to a further and still greater development of socialist agriculture. For this development, all the necessary economic and political prerequisites have matured in recent years.

The planned reorganization, as stressed in the decision of the Plenum and the propositions of N.S. Khrushchev's report, must be introduced gradually, with consideration of the specific conditions in different areas and of the possibilities of the kolkhozes, tolerating no bureaucratism or undue haste.

The decision of the Plenum of the Central Committee of the CPSU and the propositions in Comrade N.S. Khrushchev's report are valuable contributions to the further development of Marxist-Leninist theory. They include the answers to the most important theoretical questions concerning the development of socialist agriculture and the further development of our country on the road to Communism. In these Party documents the questions of combining the two kinds of property — national and kolkhoz — in the period of transition from Socialism to Communism have been elaborated creatively and in the spirit of Leninism, and the need to strengthen both national and kolkhoz property has been established.

V.I. Lenin, who with the insight of a genius drew up the cooperative plan for reorganizing agriculture along socialist lines, advanced the important principle that cooperatives are socialist establishments, provided that ownership of the means of production is concentrated in the hands of a proletarian state and that the alliance of the working class with the peasantry is secured under the leadership of the working class. Here Lenin had in view the key economic positions of the national economy: large-scale nationalized industry, transport, land, mineral resources, banks, etc. Nevertheless, the great Leader and Teacher of the Communist Party never contraposed the government and cooperative sectors. He stated definitely that the growth of the cooperative system was identical with the growth of socialism.

It is on these principles that the Communist Party bases its policy in respect to the continuous development of socialist agriculture. The growth of cooperative and kolkhoz property fully corresponds to the interests of the building of a Communist society. In the propositions of N. S. Khrushchev's report a profound analysis is given of the qualitative changes in the development of kolkhoz property. It is emphasized that this property has been created by the collective labor of the kolkhoz peasantry, with the active participation of the working class and the entire nation and with government aid playing a decisive part. Under these conditions, cooperative and kolkhoz property approaches national property more and more. The measures proposed by the Plenum of the Central Committee of the CPSU are based entirely on the need for further strengthening both the national and the cooperative kolkhoz property.

In connection with the reorganization of the machine-tractor stations, the procedure and the conditions of selling agricultural machinery to the kolkhozes have been worked out in the decision of the Plenum and propositions of Comrade N. S. Khrushchev. It is stressed in these documents that "the sale of equipment to kolkhozes is a question of great political and economic significance. Its solution affects the interests of millions of kolkhoz members as well as the interests of the Government."

The Central Committee of the CPSU has entrusted the regional committees, regional executive committees, territorial committees, and territorial executive committees to study thoroughly the economic structure of different areas and kolkhozes and on the basis of general principles to work out specific measures for the sale of agricultural machines to kolkhozes, taking into account the peculiarities of each area.

The Central Committee of the CPSU warns against a mechanical approach to the reorganization of the MTS and points to the necessity of taking into account local conditions and the economic status of the kolkhozes. In the decision of the Plenum of the Central Committee of the CPSU and in the propositions of comrade N. S. Khrushchev's report, the functions of the repair and technical stations and the problems of the material and technical supply of kolkhozes have been defined, and serious attention has been given to the organization of the procurement of agricultural products after reorganization of the MTS.

Considering the fact that the reorganization of machine-tractor stations is of great importance to the state, the Plenum of the Central Committee decided to bring it up for consideration at the session of the Supreme Soviet of the USSR, but before considering it at the session, to conduct an open discussion of the proposed measures at general meetings at kolkhozes, MTS, sovkhozes, industrial enterprises, construction projects, scientific organizations and educational institutions, in military units and establishments, and on the pages of newspapers and magazines.

The Plenum has required Party committees and Party organizations to disseminate widely the explanation of the proposed measures and to organize public discussion of the propositions in Comrade N. S. Khrushchev's report, to study closely and to generalize the suggestions made by the working people regarding improvement of the organizational forms, the strengthening and development of the kolkhoz system, and the further development of socialist agriculture.

The entire Soviet people are discussing with great interest and enthusiasm the resolution of the February Plenum of the Central Committee of the CPSU and the propositions of Comrade N. S. Khrushchev's report. The Soviet people see in these documents renewed concern of the Party for the further growth of our Motherland, for the greater welfare of the workers, and for further strengthening of the might of the socialist state.

The published documents on the further development of the kolkhoz system have called forth an enormous surge of creative activity on the part of the Soviet people. In all corners of our great Motherland active discussion of the historic documents of the Communist Party is taking place. Every citizen of the Soviet Union considers the solving of state problems his vital concern. Everywhere general meetings of workers, kolkhoz members, the Soviet intelligentsia, and servicemen are being held. Scores and hundreds of letters arrive at newspaper and magazine editorial offices. And everywhere — at the meetings, in the letters, in the pronouncements of the Soviet people — one hears the voice of general approval of the wise policy that is being put into effect by the Communist Party.

The personnel of the Air Force, as all the men of the Soviet Army and Navy, strongly approve the proposed measures of the Party on the further strengthening of the kolkhoz system and even greater expansion of socialist agriculture. The military airmen fully understand that implementation of the decision of the Central Committee of the CPSU will further the growth of the welfare of all Soviet people, strengthen our economic structure and the defensive capacity of the Soviet state.

In the unit where Comrade N. S. Ponomarev is the Party Organization Secretary a Party meeting was held at which the decisions of the February Plenum of the Central Committee of the CPSU and the tasks of Communists were discussed. Comrade Ye. F. Tolochko, director of an MTS, and Comrade A. M. Tarasevich, brigade leader at Gastello Kolkhoz and Hero of Socialist Labor, were invited to the meeting.

Navigator officer B. N. Koryakin, a former agronomist, took part in the discussion. He explained the meaning of the decision of the Plenum of the Central Committee of the CPSU and illustrated it with specific examples.

Comrade Tarasevich told the Communists about the work on his kolkhoz. He reported that there were 29 trucks and 6 tractors at the kolkhoz. In the course of this year the kolkhoz can acquire all the equipment it needs. The kolkhoz members unanimously approve of the Party decision.

MTS Director Comrade Tolochko said in his speech that at present the organization of labor at kolkhozes is very efficient. Every kolkhoz has trained its own cadres and they can successfully organize efficient utilization of equipment. He reported to the men that the cadres of mechanizers are willingly going to work on kolkhozes.

All Communists heartily approve the decision of the Plenum of the Central Committee of the CPSU. To the concern of the Communist Party they respond with new successes in political and combat training.

Servicemen visit kolkhozes on their days off duty. They speak to the kolkhoz members and hold discussions. Airmen are welcome guests at kolkhozes.

In the units and groups of the Air Force, active discussions of the decisions of the February Plenum of the Central Committee of the CPSU and the propositions of Comrade N. S. Khrushchev's report are carried on. These historic documents are discussed at meetings and elucidated during periods of political information and discussion. They are studied by the enlisted men in their political study groups. Propaganda work is carried on actively by commanders and political workers, and the cooperation of a wide circle of officers, propagandists, and agitators has been enlisted.

In response to the decision of the Plenum of the Central Committee of the CPSU, the military airmen have rallied more closely around the Communist Party of the Soviet Union and its Leninist Central Committee. With great creative enthusiasm they are perfecting their combat skill, mastering modern aviation equipment, increasing the combat readiness of air units and the quality of combat and political training, and strengthening military discipline.

The Air Force, like the Soviet Army and Navy, is vigilantly guarding the state interests of its socialist Fatherland. It is guarding the peaceful labor of the Soviet people in the making of Communism.

ON THE ESSENCE AND PRINCIPLES OF ONE-MAN AUTHORITY IN THE SOVIET ARMED FORCES

Lt. Col. A. M. LAR'KOV,
Candidate of Historical Sciences

Guided by the Marxist-Leninist teachings on war and the Army, the Communist Party has developed thoroughly the basic principles of organization of the Armed Forces of the Soviet State. It has firmly and consistently pursued and continues to pursue a course aimed at the centralized leadership of troops, at one-man authority in the Armed Forces, for it considers the latter to be the best form of controlling the troops, since it corresponds to the very nature and function of the Armed Forces and meets the requirements of present-day military science.

In creating a regular, strictly disciplined army, V. I. Lenin pointed out that in army leadership, we must have the strictest centralism, unity of will and actions on the part of thousands of men, with a high degree of discipline and organization. "One must fear guerilla organization", wrote V. I. Lenin, "the self-will of individual detachments, and disobedience to the central authority as one fears fire, for this leads to destruction..."

However, in the early period of the organization of our Army and Navy the necessary prerequisites did not as yet exist for introducing one-man authority, since there were not enough proven military cadres devoted to the revolution. Many commanders who had been promoted from the ranks of workers and peasants did not have adequate military training, and therefore the Party was compelled to bring into the Army old military specialists, some of whom did not believe in the durability of the Soviet Government and some even regarded it with hostility and frequently committed treason.

For the strengthening of Party leadership among the troops, for Communist indoctrination, and for the political and ideological cohesion of Soviet soldiers, as well as for the purpose of controlling the activity of the old military specialists, the Institute of Military Commissars as the direct representatives of the Party and the Soviet Government was introduced in the Army and Navy in 1918, and Political Organs and Party Organizations were formed. The Party sent its most prominent workers to leading posts in the Armed Forces. Tens of thousands of Communists cemented the ranks of the Army and Navy.

Favorable conditions for putting one-man command into practice took shape only after the triumphant termination of the Civil War. In 1925, during the period of carrying out a military reform, the Central Committee of the Party accepted a

Decree concerning one-man command in the Army and Navy. One-man authority was not yet complete at that time and was carried out in two forms: military commissars remained with non-Party commanders and chiefs, but their control functions were limited; Communist commanders who, in accordance with the level of their training, could at the same time carry out the duties of commissars had assistants for political affairs.

As the command cadres grew in the military and political respect, their rights and obligations were expanded, and their responsibility to the Soviet State was increased.

The Party always regarded the Institute of Military Commissars as a temporary measure dictated by special circumstances. The Party introduced it again at the beginning of the Great Patriotic War, but not in order to check on the commanders— rather because tremendous responsibility and great difficulties and ordeals had devolved upon the commander. The political workers had to take upon themselves not only the political but also a share of the administrative functions in order to make it possible for the commanders to occupy themselves more with operational and tactical problems, to get to know the enemy, and to destroy him definitively.

The military commissars carried out with honor the tasks which had been placed upon them. The command personnel acquired combat experience, became seasoned in battles, and became mature in all respects.

Proceeding from that, the Presidium of the Supreme Soviet of the USSR issued a Decree in October 1942 "On the Establishment of Full One-Man Authority and the Abolishment of the Institute of Military Commissars in the Red Army". In the decree it was stated that "...new circumstances connected with the growth of our command and political cadres testify to the fact that the reason has completely disappeared for the existence of the system of military commissars".

Full one-man authority means the abolishment of the division of authority. Full one-man authority is the kind of administration in which the full measure of power in a military unit, on a ship, in an Air Force command, in a training establishment and a military institution is concentrated in the hands of the commander or the superior officer.

Since it is the most nearly perfect system of controlling troops, one-man command has been called upon to guarantee the following: unity and centralism — and at the same time maximum flexibility and operational efficiency — in controlling the troops and their combat operations; initiative and freedom of commanders in reaching decisions in accordance with the missions which they have been assigned; full responsibility of the commander for all aspects of the life and combat activity of the troops entrusted to him; correct formulation of training and orientation for his personnel, as a single process; a high degree of discipline and organization; organization of effective control over the fulfillment of military regulations and orders of higher authorities.

The Soviet commanding officer, within the limits of the mission and responsibility assigned him, is granted great authority. The order of a superior is law for his subordinates, and the unquestioning fulfillment of the requirements of regulations and subordination to one's superior is a law of military service.

Our military commanders have been justifying with honor the confidence of the Party, the Government, and the People. The Great Patriotic War confirmed this in brilliant fashion.

Through its untiring organizational and indoctrination work, the Communist Party has reared the best officer cadre in the world, a cadre which represents the backbone of our Armed Forces, binding them into a single disciplined organism. A new type of officer has been created — a man of the people and its faithful servant, boundlessly devoted to his Motherland, equipped with the Marxist-Leninist philosophy and the most advanced military science in the world.

One-man authority in the Soviet Armed Forces rests upon firm and indestructible foundations, the likes of which do not and cannot exist in the armies of capitalist states. There is no class unity there, no community of interests and purposes between the rank and file and the command personnel, since the officer corps, being a closed caste of imperialist military menials, opposes the basic mass of soldiers and sailors as an alien and hostile force. Under such conditions there is no social medium for a reliable, durable, and stable rallying of the soldiers around their superiors, while one-man authority is reduced to a means for suppressing the will of subordinates.

Complete moral and political unity of the entire personnel has been achieved in the Soviet Armed Forces. The ideology and policy of the CP, expressing the basic interests of the entire Soviet people, ideologically and organizationally unite all Soviet warriors, from soldier to marshal, in a single monolithic combat team.

Among us, one-man authority and the leader activity of the officer cadres rest on the Soviet socialist patriotism of the soldiers and on their highly developed sense of duty to the Motherland, on conscious discipline and on a high level of combat activity. That creates the most favorable conditions for productive activity on the part of the command personnel.

The present-day international situation, the swift development of military technology and methods of armed combat dictate urgently the necessity for further intensification and constant improvement of the combat readiness of our Armed Forces, and of the leadership and control of the troops. In modern warfare, a control of the combat operations of troops which will guarantee efficient cooperation of all arms is mandatory. Success in present-day combat and operations depends to a great extent on swiftness in reaching the most nearly correct decisions and carrying them out, i.e., on the timely influence of the commanders on the course of the battle.

Corresponding to the tremendous scope of responsibilities resting on the commander with one-man authority, he needs many-sided and extensive knowledge. Let us take an Air Force commander, for example. His activity is extremely varied and complex. It requires many-sided knowledge, a high degree of political maturity, the ability to direct all Air Force services that support flying training. The Air Force commander is not only the organizer and leader of flight training, but he is also a pilot. Under his command are officers with the most varied specialities. To direct them, to be able to notice shortcomings in time, to help the officers, to teach and indoctrinate them — all that is a very complex and responsible job. For that purpose the commander must be well acquainted with the special features of the service and the work of each of his subordinates, and possess the necessary knowledge of many Air Force disciplines.

The Air Force commander trains and indoctrinates officers — both pilots and navigators. He organizes and, together with them, carries out missions in the air.

From that it is clear how attentively each Air Force commander is obliged to concern himself with his own personal improvement, to have a deep understanding of Party principles, of leadership, and troop control, and of the principles of one-man authority in the Soviet Army. Without all that, further growth of officer personnel authority, improvement of troop leadership, and improvement of their combat readiness are impossible.

In actual Army life and the work of our officers there are still individual instances of misunderstanding and sometimes even of misinterpretation of the essence of the Leninist principles of one-man authority, of deviation from those principles, of violation of the regulation requirements in the mutual relations between superiors and their men. Some officers who are immature in the political sense have a very narrow understanding of leadership and troop control; they reduce it to a simple formal division of servicemen into superiors and subordinates. Actually that is an important and complex problem which cannot be placed in such a narrow formal framework.

One-man authority, as the best form of troop control, rests among us on the collective leadership by the Communist Party of all the Armed Forces, on the Party's military policy. And from that it follows that every military leader (superior) is the guide of the collectively developed policy of our Party and Government, the servant of the people, and the exponent and defender of its interests and its will. In his entire activity he is guided by the policy and ideology of the Communist Party; he proceeds from the Marxist teaching on the deciding role of popular masses in history, including wars, and he leans on the support of the masses.

The higher the political maturity and toughness of our officer cadres, and the deeper the understanding they have of the policy of our Party, the more successfully and fruitfully are they able to carry out the role of leaders in the Armed Forces of the USSR.

The commander in the army of a socialist state is not simply and solely a superior who has been granted great authority and power; he is a military and political leader and an educator of men. Every commander (superior) exercises authority within the limits set for him under the supervision of the Party and he acts in complete conformance with its directives and with the laws of the Soviet state. Fulfillment of the policy of the Party and of its Central Committee is a basic principle in the building of our Army, and in the leadership of the Soviet Armed Forces as a whole.

In developing the principles of building up the Armed Forces of the Soviet State and of their administration, the Party has always been directed by the instructions of V. I. Lenin concerning the fact that the policy of a military department — as indeed of all other departments and establishments — is conducted upon the exact basis of general directives which are given by the Party in the person of its Central Committee and under the direct supervision of the latter.

The October Plenum of the Central Committee of the CPSU decisively condemned a departure from these basic principles of Leninism. In the decree of the Plenum the following statement is made: "The Plenum of the CC of the CPSU notes that recently former Minister of Defense, Comrade G. K. Zhukov violated the Leninist Party principles of leadership of the Armed Forces, conducted a policy aimed at curtailing the work of the Party Organizations, Political Organs, and Military Councils, and at the liquidation of leadership and control over the Army and Navy on the part of the Party, its CC, and the Government".

Some officers' failure to understand the essence and significance of Soviet one-man authority in the light of Marxist doctrine concerning the decisive role of the popular masses in history, and in the light of the Leninist principle of board administration as the basic principle of Party and State leadership, leads to grave errors in actual practice.

Leninism teaches that acknowledgement of the decisive role of the popular masses in history does not preclude but rather presupposes acknowledgement of the important role of personalities, chiefs, leaders, and military commanders — but on one indispensable condition! that these personalities express the interests of social progress, the interests of the popular masses, and stand at the head of the masses and lead them. A leader without the masses is not a leader but a lone wolf.

In exactly the same way, the acknowledgement of board administration as the basic principle of Party and State leadership does not exclude but necessarily presupposes the personal responsibility of every worker for the segment of work assigned him and presupposes also one-man authority in the administration of individual branches of State activity, including control of the Armed Forces, as the type of command that corresponds best to their specific features and function. One must not underestimate, much less ignore, these specific features. But one must not make them absolute either. Questions of military development are regarded by the Party as having an organic connection with questions of general Soviet and Party development. "The building of our Army was successful", wrote V. I. Lenin, "only because it was achieved in the spirit of overall Soviet building." Guided by this Leninist principle, the Party has indeed developed Soviet Socialist principles of leadership and one-man authority in the Armed Forces.

Our Party manifests constant concern for strengthening one-man authority, improving and actuating the work of the Political Organs and Party Organizations, and for strengthening the ties of all Army Communists with the Party and with the Political Organs.

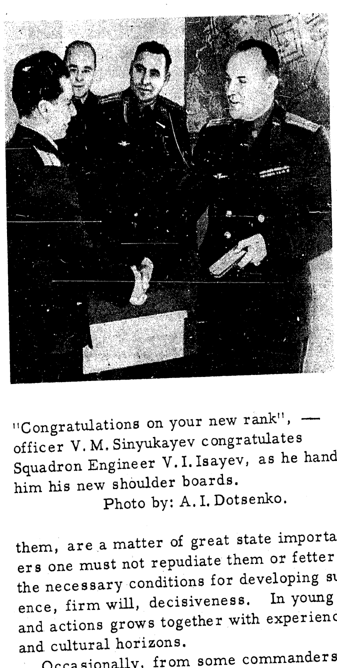
One-man authority in the Armed Forces of the USSR, even the most all-embracing does not by any means constitute unlimited power in the hands of individuals. The authority of every superior and the norms of his mutual relationships with his men are strictly defined by our regulations.

A false, non-Party interpretation of one-man authority as the completely unrestricted and uncontrolled power in the hands of individuals is directly connected with the cult of personality alien to Marxism and Leninism.

Men who are immature in reference to the Party and who in addition are power-loving, who do not understand and indeed sometimes do not even want to grasp the Leninist principles of one-man authority, identify it with the special role of individual persons. For them, one-man authority is not a form of administration of troops, the principles of which have been strictly defined by our Party within the framework of overall Party and Soviet development, but something in the nature of a grant of feudal prerogatives.

Deviation from the Leninist principles of leadership of the Armed Forces, and a distorted interpretation of one-man authority and subordination give rise among some military workers to forms and methods of work that are alien to our Party and its cadres: alienation from the masses, barren bureaucratism, underestimation of Party-political work, and conceit. Such forms of leadership result in a weakening of moral and combat unity among the personnel — the basis of the combat readiness of our Armed Forces — to a disruption of the relationships and cohesiveness among soldiers and officers, superiors and subordinates, commanders and political workers.

The harm of such forms of leadership lies in the fact that on the one hand they fetter the creative initiative of the subordinates, give rise to lack of confidence in one's work and to a fear of responsibility, and on the other hand, contribute to the spread of such a negative phenomenon as sycophancy.



"Congratulations on your new rank", — officer V. M. Sinyukayev congratulates Squadron Engineer V. I. Isayev, as he hands him his new shoulder boards.
Photo by: A. I. Dotsenko.

Incorrect methods and forms of leadership gave rise to serious shortcomings in the indoctrination of young officers. Yet assistance to young officers in their work, indoctrination and expert leadership of them, are a matter of great state importance. When working with young commanders one must not repudiate them or fetter their initiative, but one must create all the necessary conditions for developing such valuable command traits as independence, firm will, decisiveness. In young officers, confidence in one's own strength and actions grows together with experience, knowledge, and military, political, and cultural horizons.

Occasionally, from some commanders who do resort to unseemly methods of leadership — crudity — one hears that they are displaying great exactingness and implanting order and discipline. Actually, however, this has nothing in common with real exactingness and the strengthening of discipline. On the contrary, crudity leads not to organization but to disorganization of work and service, not to strengthening but to weakening of discipline, for it discomposes people and evokes a feeling of bitter resentment.

Our Army is strong in conscious discipline, at the basis of which lies the profoundly recognized sense of personal responsibility of Soviet soldiers for the defense of the great achievements of Socialism. For this very reason they displayed unprecendented heroism in battles with the enemy.

Of course not all our soldiers are equally conscientious and disciplined, but they must all be indoctrinated in the spirit of deep responsibility for the fate of the Motherland. For conscientious soldiers, strict military discipline and obedience to one's

superiors is never a burden, since they recognize its necessity. It goes without saying that discipline and obedience are obligatory for all — for both those who have realized and those who have not yet realized the necessity for them. For the latter, coercive and punitive measures are appropriate and in order. But we must not confine ourselves to such methods alone.

We often say, and very rightly so, that an army must live and operate like a well-adjusted clock mechanism. But this mechanism does not consist of mechanical parts at all. Its "cogs" are living Soviet men with their feelings, ideals, and habits.

The moral force of our Army is a great force. The outcome of a war, as V.I. Lenin taught, is in the last analysis decided by the esprit of the masses who carry on the war, and shed their blood. From that it follows that a Soviet commander must be a skillful educator capable of influencing the conscience, feelings, and actions of his men, and must always be able to draw a strict boundary between exactingness and will on the one hand as the most precious qualities of a Soviet commander, and, on the other hand, coarseness and arbitrariness as qualities which are profoundly alien to a Soviet commander.

The Soviet Army has created a type of commanding officer who is strict but just, considerate and attentive, restrained and tactful. Coarseness never was and never will be a sign of the will, exactingness, and resoluteness of a superior. On the contrary, it testifies to the helplessness of the leader, to his inability to lead men in the true sense of the word and with full knowledge of his work, to the low level of his culture, to his forgetting the elementary requirements of Communist morality, of Soviet laws, and of military regulations. One-man authority is not arbitrariness: "I do as I please". Our Party wages a merciless battle against such methods of leadership.

"...the internal structure and order of the Army of the Workers and Peasants Soviet State", wrote M.V. Frunze, "must be free of all privileges that are not necessitated by the requirements of the service and do not follow from its nature. Only on such soil is conceivable the realization of comradely cohesion and mutual understanding between Army superiors and subordinates, which are the basic guarantee of the physical and spiritual power of the Red Army".

Every Soviet commander and superior officer is a leader of the masses. The tasks assigned a military unit and group are solved under his guidance by the entire personnel, and no matter how capable and energetic the superior may be, he is not in a position to solve them alone. His capabilities as a leader are revealed in full force precisely by how well he organizes a job and mobilizes the personnel to carry out assigned tasks.

Soviet one-man authority lies not only in the ability to give an order, to demand an account, but also in the ability to organize a task, to select and allocate personnel, to rely for support in one's work on the Party and Komsomol Organizations, and to make fuller use of their great power. But that presupposes that in his varied activities the commander must take counsel with his deputies and assistants, support valuable undertakings and suggestions, and encourage their initiative. Every commander must foster within himself the need to mix with the team. He must be able to hear out both his equals and his subordinates, take counsel with them, and reach decisions while taking their suggestions and opinions into account. Commanders with one-man authority cannot forget that their orders have the force of law. It is precisely that circumstance that places special responsibility upon them for their orders and instructions.

Only a politically immature and conceited worker who does not understand the essence of Soviet one-man authority, who has lost contact with life, can despise the counsels of others and regard every piece of advice from his subordinates as a blow to his own rights and authority. On the contrary, the commander's authority depends directly on the extent to which he is able to lean upon the team of men under his leadership and to make use of their knowledge and experience.

The art of leadership must be studied with an unsurpassed leader like V. I. Lenin. One of the most powerful aspects of Lenin's leadership was his amazing ability to listen to what others were saying, to analyze suggestions and to draw conclusions from them. Lenin's style of work is our invaluable heritage and we must study it.

"The strength of our Army", said V. I. Lenin, "is in the closeness of the command personnel to the masses of Red Army soldiers." The commander, the superior, must constantly see to it that the men regard him as a person who is exacting and strict but who is at the same time close to them, a just, thoughtful, and sympathetic superior.

Let us call to mind how V. I. Chapayev, the legendary hero of the Civil War, formed his relations with his men. He used to say to them: "On duty, I'm your commander, but after duty, come to see me. If I'm dining, have a seat and dine with me; if I'm drinking tea, sit down and have some tea with me." And yet some of our superiors, in their relations with their men, are always and in every respect official to such an extent that they've begun to consider it almost degrading to have any contact with their men, assuming, apparently, that "the feeling of remoteness" exalts them. Alienation from the masses, contempt for the vital needs of other men — this is a dangerous disease. It leads to the loss of Party spirit and of high principles, i. e., to the loss of qualities without which a genuine Soviet military superior is unthinkable.

In accordance with the principles of Soviet one-man authority, the Interior Service Regulations require the superior to become thoroughly acquainted with his personnel, to know the abilities of each of his men. A politically mature and experienced officer will always find the opportunity to have a heart to heart talk with his men, to form for himself a clear idea of their personal qualities, to clarify their mental attitudes, their needs, and spiritual interests, and to help them with deeds and with kind advice. That makes it possible for superiors to know constantly about the difficulties encountered by their men, to anticipate possible frustrations and to forestall them in due time, to exert an active influence on the mens' conscientiousness and actions — something that is especially important in the Air Force. For such an officer, unexpected occurrences in the conduct of his men are hardly likely.

Deviations from Lenin's principles of leadership of the Armed Forces and distortion of the Party principles of one-man authority have led to the weakening of Party-political work in the units, and to a belittling of the role of the Army Political Organs and Party Organizations. And yet one-man authority in the Army not only does not denote any belittling of Party-political work, but, on the contrary, intensifies its significance, increases the responsibility of the commanders and Party-political workers towards the Party, the Government, and the People in the matter of training conscientious, manly, and able defenders of the Motherland.

Party-political work is not the allotted department of the political workers. It is the work of our Party in the Army, which it carries on through the political Organs and Party Organizations and in which all Army Communists are obliged to participate.

Underestimation of Party-political work was leading to the spread of an absurd — from the point of view of an elementary comprehension of Party tasks in the Army — opposing of political workers to commanders, was weakening their friendly joint work in the solution of problems they share in common and in the achievement of mutual goals for strengthening the combat power of the Armed Forces.

Bureaucratic methods had here and there begun to spread even to Party-political work. The leading role of the Political Organs with respect to the Party Organizations was often belittled, since, in spite of the Regulation of the CPSU, the leadership of the Political Organs and Party Organizations had been given to the commanders with one-man authority.

In the life of the Army Party Organizations, the role of criticism had been strongly disparaged under the pretext of specific Army conditions. All this had been weakening their activity in the solutions of problems of combat training, their influence on the life of the troops; all this had led to training Army cadres erroneously with respect to Party principles and the standards of Party life; had been leading, not to the strengthening, but to the weakening of one-man authority, since without criticism and self-criticism without well-formulated Party-political work, the Party Organizations cannot be an effective support for the commander.

Our Party takes the specific conditions of Army life into consideration. Precisely for that reason discussion and criticism of a commander's orders are not allowed.

Occasionally people say that criticism undermines the authority of the commanders. Not at all. Party criticism does not undermine authority but, on the contrary, strengthens it — if of course one takes the criticism in Party spirit and reaches the correct conclusions from it.

After all, what is authority? How is it maintained? The authority of the leader lies in the respect, the confidence in him on the part of the Party, the People, and the team. A firm authority constantly growing stronger is maintained through good work, through the results of that work, through high personal qualities of the worker in political and practical matters, and through the strong ties between the leader and the masses. And criticism is called upon precisely for the very purpose of improving the work, of perfecting the personal qualities of the leaders, of bringing them close to the masses and, consequently, of enhancing their authority.

The authority of any worker, particularly of a commander, is a great force. After all, scores, hundreds, and thousands of men go into battle behind him, upon his orders, and under his leadership. Consequently our Party and people are vitally interested in seeing to it that the authority of the commander and superior be supreme.

The most important condition for the supreme authority of an officer is his personal exemplariness in every respect — in training, in discipline, and in daily life.

We say that the Party Organizations and Political Organs must protect and support the authority of the commander. But after all, that can be done only if there is something to support and protect, when this authority exists. It would be pointless to support and protect that which does not exist.

Authority is not an anniversary gift. It is not issued even as an honorary supplement to one's position and rank. It is acquired through one's attitude towards work, towards the fulfillment of one's duties, and through the deeds and capacities of each man.

At past Party meetings and conferences, the Communists spoke with great warmth and love about a great many officer-leaders, men who work selflessly, have a deep sense of responsibility, and are strong-willed and cultured, and who at the same time are modest, and close and accessible to their comrades and men. In the Greetings of the Central Committee of the CPSU, of the Presidium of the Supreme Soviet of the USSR, and of the Council of Ministers of the USSR to the men of the valiant Armed Forces of the Soviet Union, stress is laid upon the fact that in the combat ranks of the Army "... remarkable cadres of commanders and political workers have emerged, who serve as an example of loyal service to the People and Party, who labor untiringly to perfect the combat training of their personnel and to improve Party-political work in the units and on the ships".

The principles of Soviet one-man authority require that the Soviet commander with one-man authority combine within him high and varied moral and combat qualities: a lofty ideology, Party maturity and high principles; a deep knowledge of his work and a creative attitude towards it; exemplariness in discipline and the ability to combine the commander's high qualities of will — firmness and exactingness towards his men — with tactfulness and sympathy; the ability to knock a strong team together and to lead it; to lean for support on the Party and Komsomol Organizations and through them to rouse the entire personnel to a solution of assigned tasks.

Commanders who have developed and cultivated such qualities in themselves, always achieve important results in their work, and surmount difficulties encountered along their way. Cultivation of those qualities is a decisive prerequisite for the successful activity and growth of officer cadres, and for enhancing their organizing role and authority among the troops.

The October Plenum of the CC of the CPSU constitutes a very important event in the life of our Party, an event that has historical significance for the Soviet Armed Forces. The Plenum is a new manifestion of the concern of the Communist Party for strengthening and intensifying their combat power. The Plenum laid the foundation for a new stage in the life of the Army and Navy.

The Plenum corrected serious shortcomings in the leadership of the Armed Forces, nipped in the bud the tendency towards alienation of the Army from the Party, towards weakening of the Party's leadership of the Armed Forces, restored the role of Party-political work to its rights, directed the efforts of Army Communists towards further strengthening of the monolithic unity of personnel, towards rallying it round the Communist Party, towards the correct training of Army cadres in the spirit of Leninist Party zeal.

The wise decisions of the Plenum of the Party Central Committee have evoked among all the Army Communists a surge of energy, the desire to work even better, to give all their efforts and knowledge to the great cause of strengthening our Armed Forces.

Party meetings and Party activs have shown how closely and indissolubly Communists are rallied round the combat staff of our Party, its Central Committee.

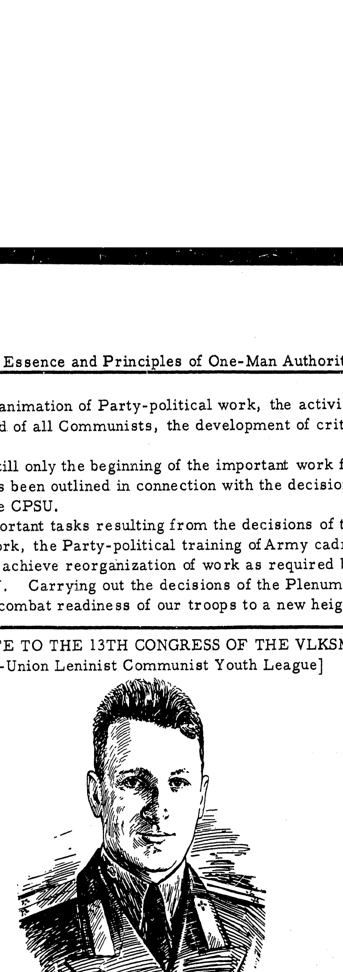
One of the most characteristic processes going on right now in the life of the

Army is the general reanimation of Party-political work, the activization of the Army Party Organizations and of all Communists, the development of criticism and self-criticism.

Of course, that is still only the beginning of the important work for surmounting shortcomings which has been outlined in connection with the decisions of the October Plenum of the CC of the CPSU.

One of the most important tasks resulting from the decisions of the Plenum is to intensify ideological work, the Party-political training of Army cadres. Without that it is impossible to achieve reorganization of work as required by the Central Committee of the CPSU. Carrying out the decisions of the Plenum helps the Army Communists raise the combat readiness of our troops to a new height.

DELEGATE TO THE 13TH CONGRESS OF THE VLKSM
[All-Union Leninist Communist Youth League]



Instructor-Pilot Lt. B. G. Samorodov is the commander of an outstanding Komsomol crew. Without regard for time, he trains young pilots, and fosters high moral and combat qualities in them. A good sportsman and a leader in sports events, Samorodov imbues his trainees with a love for sports.

Comrade Samorodov is the deputy secretary of a squadron Komsomol Bureau. For outstanding ratings in combat training and political training and for active participation in Komsomol work, he has been recommended for the award of Certificate of Honor by the CC of the VLKSM.

The Komsomol members showed their high confidence in Lt. B. G. Samorodov by electing him delegate to the 13th Congress of the All-Union Leninist Communist Youth League.

In the sketch: Lt. B. G. Samorodov

AERIAL RECONNAISSANCE UNDER ADVERSE WEATHER CONDITIONS

Lt. Col. T. S. GORYACHKIN,
Hero of the Soviet Union

In the last war, darkness and adverse weather conditions were utilized for covert preparations for battle or operations. There also arose a need for carrying out air reconnaissance under these condtions, which limited to a certain degree the operation of the enemy's AA defense facilities, reducing their effectiveness. Furthermore, interception of reconnaissance aircraft by fighters was also complicated. But it must not be forgotten that at the present level of development of AA defense facilities these advantages are reduced considerably.

A modern AA defense system is capable of bringing organized counteraction to bear on a reconnaissance aircraft by various means. Either in an adverse weather situation or at night, the plane can be located by radar stations long before the approach to the objective and fighters can be sent out to meet it.

As the reconnaissance plane approaches the objective, guided missiles, antiaircraft artillery, and barrage balloons will be brought to bear on it. Consequently, darkness and adverse weather conditions have begun to lose their advantages in concealing the flight of a reconnaissance aircraft. Therefore, secrecy of the flight and surprise appearance over the objective to be reconnoitered have acquired exceptional importance. To achieve this and thereby reduce the effectiveness of the AA facilities, various measures — both on the ground before flight and in the air — can be taken.

First of all, it is necessary to study well the objective of the reconnaissance, the AA defense facilities that the crew may meet along the flight route and in the target area, and the tactics of the enemy's fighters. This will make it possible to choose the route and the flight profile correctly, to propose measures for overcoming the AA defenses, and to find the best tactical means and methods of air reconnaissance.

Avoiding areas that are not to be reconnoitered but are covered by strong AA defense facilities, the reconnaissance plane approaches the object to be reconnoitered covertly. If the target is at a considerable distance from the front line, it is advantageous to fly to it at an altitude at which fuel consumption is minimal, irrespective of the thickness and height of the upper deck of the cloud cover. In this connection, it should be kept in mind that high altitude does not ensure concealment from the enemy's radar facilities, since their detection range is related directly to the aircraft's flight altitude. Thus, in a number of cases it is still expedient for the reconnaissance plane to travel at the minimum altitude (particularly on the last leg

of the route before the target).

The flight to the reconnaissance area and back is made both over friendly territory and over enemy territory. The leg of the route to the front line is considered safer as far as enemy fighter counteraction is concerned as compared to flight over hostile territory. However, under conditions of utilizing new ways of fighting, it is not impossible that there will be fighter counteraction against a solitary reconnaissance aircraft even over friendly territory, where it can be discovered by radar facilities.

It is very important under adverse weather conditions and at night to inform the crew in good time of the situation in the air. This knowledge will make it easier for the reconnaissance plane to evade enemy fighters. To this end, the areas covered by the fighter forces of the enemy, if they are not the object of reconnaissance, are bypassed or are flown over at high altitudes. The vectoring of the enemy fighters can also be made more difficult by changing course and altitude. But it must always be kept in mind that modern fighter interceptors carry special equipment that permits making the entire process of interception automatic. In addition, they are subject to preliminary vectoring from ground radar spotting and vectoring stations.

In the approach to the front line and the reconnaissance objective, the reconnaissance aircraft may encounter antiaircraft artillery action; hence the necessity for timely AA and rocket evasion maneuvers — changes in the direction, altitude, and speed of flight, intensified observation of the air.

The destructive capabilities of AA defense facilities, as is known, depend to some degree on how the aerial target is moving: evenly and in a straight line, in a straight line with acceleration or with deceleration. It is easier to intercept and hit an aircraft if it is flying in a horizontal regime; and conversely, it is more difficult when the plane is changing course, speed, and altitude. This, of course, does not mean that it is necessary to "toss" the plane around from side to side during the entire flight when there is no need for it. Everything must conform to the situation.

Darkness and various weather phenomena — cloudiness, fog, haze, snow, rain — reduce vertical and horizontal visibility and complicate air reconnaissance. Reduced illumination of the earth's surface makes it more difficult or virtually impossible to take aerial photographs without artificial lighting and the use of light-sensitive photographic materials or radar and other equipment.

However, darkness and adverse weather conditions may to a certain degree facilitate the carrying out of missions. If, for example, the objective of the reconnaissance is far from the front line, it can be reached by flying in or above the clouds, coming out at a characteristic check point located to the side (on the flank) of the objective being reconnoitered. It is sometimes possible to approach the check point by means of a radar sight. Penetration of the cloud cover to a safe altitude is checked by a radio altimeter. After regaining orientation, the crew continues to fly in the clouds toward the objective in such a way that exit from the cloud cover coincides with the start of reconnaissance.

Inadequate visibility compels the crew to reduce flying altitude in the visual method of reconnaissance; this, as a consequence of the considerable angular distance of objects at high flying speeds, makes observation of them more difficult. In addition, the crew's time of observation at a low altitude is extremely limited. In connection with this, it is necessary to make more than one pass or to plan and execute a complicated maneuver. The quality of the reconnaissance in such a case will depend considerably on how well the crew studies the objective in advance.

However, aerial reconnaissance at low altitudes also has its positive aspect: it ensures secrecy in the flight of the aircraft and surprise in its approach to the objective. In flying at low altitudes, moreover, not all the AA defense facilities can function effectively. The fighter forces are also limited in their maneuvering in attacking the reconnaissance plane.

Reconnaissance can also be made by photography and by visual observation simultaneously, with the photographing being done either from an oblique mount or from a vertical mount by banking the plane. In either case the aircraft can pass to the side of the reconnaissance objective, which ensures against being hit by the fire of the enemy's AA artillery.

When the cloud cover (not more than 3-4 points) has breaks, the reconnaissance plane flies above the clouds, and the objective is observed in the spaces between them. In this, it is necessary to take into consideration the fact that in flying above the clouds the speed and altitude affect the duration of visual observation through the spaces between the clouds. The greater the altitudes over the cloud cover, the less is the angular distance of the plane in respect to it, and therefore, the more time for observation of the reconnaissance objective through the "windows". At higher speeds the angular distance, naturally, increases. With greater cloudiness, the possibility of photographing or scanning the objective on a single run is not very great, because the time of flying over a "window" is very brief.

For proper utilization of the cloud cover, the reconnaissance crew studies the nature of the cloud cover along the flight route and in the target area even before taking off. It happens sometimes that the crew covers part of the route in good weather, but encounters adverse weather conditions over enemy territory, and vice versa.

If the weather in the area of reconnaissance is not known in advance, then the crew climbs to the highest altitude so that it can continue the flight and make the reconnaissance from a high altitude in the event the weather conditions over enemy territory are good, or descend and carry out the reconnaissance from beneath the clouds if there is a cloud cover.

If there is a thick haze over the enemy territory, it is better to fly at a high altitude. The crew can obtain good reconnaissance results if it is directly over the objective or not far from it. In photographing, light filters are used, reducing the deleterious effect of the haze on the quality of the negative.

Precipitation (snow, rain) sharply reduces the possibility of visual observation and photographing. For reconnoitering airfields, railroad terminals, and other large objects under such conditions, one also flies in or over the clouds, coming out of them in the area of the target. The objective will be seen better if the plane goes over it at a low altitude or not too far from it. In the first case, the observation is conducted through the bottom ports of the cabin, and in the second case through the side ports. When the aircraft turns away from the objective there is the possibility of visual observation, and when it is turning toward it there is the possibility of oblique photography with the vertical mount.

In the flight, the crew may have to cross a weather front or enter an area of thunderstorm activity, particularly when the weather situation is not known well enough. Thunderstorm activity will compel the crew to deviate from the axis of the route in flying to the reconnaissance objective. It is better to fly either to one side of a thunderhead or over it.

Cirrus and cirro-cumulus clouds are not always favorable for concealment. As a rule, they have a small vertical thickness, and visibility in them attains several kilometers. However, even such clouds can be utilized for concealment, by flying above the deck of the cloud cover and coming out underneath it in the area of the reconnaissance objective.

Cirro-stratus clouds attain a considerable thickness, and visibility in them is low. Such clouds are considered the most favorable for concealment from enemy fighters.

With a multi-layer cloud cover, when the lower stratum is less than five points, it is possible to fly in the clouds or below the top stratum. Under such conditions the reconnaissance is made through the breaks. If the bottom stratum is more than five points, i. e., does not permit viewing the objective, it is best to fly below the base of the cloud cover.

In flying at medium and high altitudes it is necessary to take into account the possibility of a contrail being formed by the plane. It betrays the presence of both our own plane and the enemy's plane. With the appearance of a contrail it is necessary to change the flight altitude.

Also to be taken into consideration is the position of the sun relative to the object of reconnaissance. In flying above the clouds, if observation is made through breaks, it is necessary to keep to the sunward side in approaching the target and to make the run on it from out of the sun. Otherwise the objective will not be seen very well and, in addition, it will be difficult to observe the situation in the air.

In relation to the nature of the objective, various tactical maneuvers and reconnaissance methods are used, taking weather conditions into consideration. It is desirable to conduct the reconnaissance of communication lines, for example, by flying in the clouds or above their upper limits, periodically coming out under the clouds for observation. In coming out of the clouds it is recommended that the position of the plane relative to the road be considered. If the road is straight for a considerable distance, it is best to cross it at a slight angle. The cloud cover should be entered and left in a straight line, and turns in one direction or the other should be made in the clouds so as to change course and confuse the enemy.

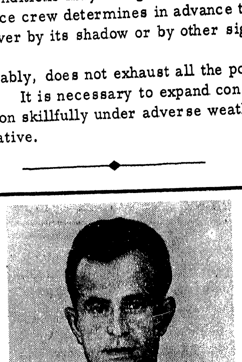
Reconnaissance of troop concentrations and other mobile objectives is best made from low altitudes and at high speeds. It is possible to fly to the area of reconnaissance in the clouds and leave the clouds so as to effect surprise. The high speed of a modern plane makes locating it by sound difficult, while a low flying altitude makes it difficult for the enemy's radar stations to detect and track it.

For a detailed examination of the reconnaissance objective in flying at a low altitude and for encompassing a greater spatial range in photographing, the crew should gain the appropriate altitude quickly close to the object of the reconnaissance (if the cloud cover permits) and, having passed it, again descend or climb and enter the clouds.

After the area of reconnaissance is passed, it is advantageous to change the direction of flight in the clouds or at the minimum possible altitude. If, for example, the direction of flight from the object reconnoitered coincides with the direction to the next object of reconnaissance, the crew can take a false course to the left or to the right and take the direction required only after entering the clouds. This method is particularly applicable under conditions when it is known in advance that enemy fighters are operating in the given vicinity.

If it is difficult to make a running reconnaissance because of a low cloud cover or heavy precipitation, then the approach to the objective is repeated on the return trip. By that time the conditions may change in favor of the reconnaissance aircraft. The reconnaissance crew determines in advance the direction and rate of movement of the cloud cover by its shadow or by other signs and decides on further action.

All the above, indisputably, does not exhaust all the possibilities for the crew of the reconnaissance plane. It is necessary to expand constantly the tactical outlook and to learn how to function skillfully under adverse weather conditions, displaying in this an intelligent initiative.



V. D. Stulenkov

Capt. V. D. Stulenkov has proved himself to be an outstanding pilot-instructor who knows how to find the proper approach to each student. His pupils are successfully mastering combat aircraft and are completing the training program with excellent and outstanding marks.

V. D. Stulenkov takes an active part in Party political work. The Communists have elected him the deputy secretary of the squadron Party Bureau.

FIRING UNGUIDED ROCKET MISSILES AT AERIAL TARGETS

Engineer Lt. Col. N. D. GRIGOR'YEV,
Docent, Candidate of Military Sciences

Unguided rocket missiles with which a fighter aircraft is equipped are divided, depending on design characteristics and the principal combat capabilities, into two types: point-detonating and time-fuzed.

Point-detonating missiles of comparatively small weight and caliber are designed, like conventional artillery projectiles, to destroy a target with a direct hit. Destruction of the target is effected with the aid of demolition and fragmentation action. The point-detonation rocket missile is superior in explosive strength to the aircraft artillery projectile and destroys a medium-size jet bomber with one or two hits.

Time-fuzed rocket missiles are usually equipped with a powerful warhead for demolition and fragmentation action which yields upon explosion several thousand fragments. The time fuze of these missiles is designed to work upon impact with the target as well as after a given time interval following launching. The time setting of the present-day fuze is set automatically depending on the range of fire determined by the range-finding device of the sight.

The target is hit by time-fuzed rocket missiles, even when the explosion occurs at a certain distance from the target due to the blast effect and especially to fragmentation. The distance between the point of explosion of a time-fuzed rocket missile and the target, sufficient to insure the latter's destruction, depends on a number of circumstances (for instance, on the heading, the rate of closure of the missile with the target, and the altitude at which the explosion takes place). In isolated instances, this distance amounts to 100-150 m.

The hit probability increases sharply with a decrease in the distance between the point of explosion and the target. This calls for special attention to aiming accuracy on the part of the fighter pilot when using time-fuzed as well as point-detonating rocket missiles.

The superiority of unguided rocket missiles over aircraft artillery projectiles lies first of all in the greater power of the former. Furthermore, they can be aimed and launched rapidly in one volley or a number of volleys (actually in 0.5 seconds). This gives the fighter considerable tactical advantages in attacks at high rates of closure when he lacks sufficient time for aiming and firing. Attacks at high rates of closure are widely employed to lower the effectiveness of bomber defensive fire and of countermeasures on the part of enemy fighters under combat conditions.

Time-fuzed rocket missiles can, in addition to this, also give the fighter considerable tactical advantages in an aerial combat with a group of bombers. For instance, in an attack on a flight of bombers flying in closed formation the effectiveness of a volley of time-fuzed rocket missiles increases approximately twofold as compared to the effectiveness of fire at a single target.

In aiming with the aid of semi-automatic sights, point-detonating rocket missiles are employed like conventional fighter artillery weapons as far as firing procedures are concerned.

Aerial gunnery with point-detonating rocket missiles is performed at ranges not over 2000 m. The rocket missile designed to be used at such distances moves one and a half times slower than an artillery projectile. With equal firing ranges, the time required to obtain the lead angle will be approximately one and a half times greater than that for cannon. Therefore, before firing a volley or a series of volleys of point-detonating rocket missiles, the pilot must aim accurately for a certain period of time, aligning the central point of the reticle with the aiming point. The period of preliminary aiming is approximately equal to the following: at a range of 1500 m — 4 sec; at 1000 m — 2.5 sec; at 800 m — 2 sec; at 400 m — 1.5 sec.

Excellent results during the winter training period were achieved by Military Pilots First Class Captains A. I. Sukhov and V. P. Ponomaryev. All missions were carried out by them with good and excellent results. In the photograph: Capt. A. I. Sukhov (left) and Capt. V. P. Ponomaryev after flights.
Photo by G. I. Makarov.

The effectiveness of firing point-detonating rocket missiles at a bomber depends to even a greater extent on the direction of attack than it does in firing from a cannon. It is known that attacks in a horizontal plane are the least effective because in this case a comparatively high rate of change of bank complicates aiming and a minimum target area is exposed to fire. Attacks in the vertical plane, particularly from above and behind as well as from above side rear (in these cases, the target area increases, particularly at high altitudes, because of the target aircraft's angle of attack)are more effective by about 20-50%. In addition, attacks from above the target offer the fighter great possibilities for speed maneuvering.

As far as the safety of the fighter from explosions of point-detonating rocket missiles is concerned, actually no limitations exist on the attack; therefore firing can be carried out even at minimum ranges.

Firing of time-fuzed rocket missiles differs significantly from firing cannon and point-detonating rocket missiles. In order to avoid damaging one's own aircraft with rocket missile fragments, the fuzes of time-fuzed missiles are equipped with inertial safety devices which control the arming of the fuze. Usually the fuze is armed after the action of the solid propellant rocket engine terminates at a distance which is safe for the aircraft making the attack. To avoid damaging one's own aircraft by fragments, it is recommended that the pilot of a single aircraft fire from the rear hemisphere at a range of no less than 400-500 m, and that firing in a group be at no less than 600-800 m.

When using conventional semi-automatic sights, firing of time-fuzed rocket missiles is most effective from the rear hemisphere with an angle-off about 0/4.

It is advantageous to employ time-fuzed rocket missiles against bomber groups for the purpose of destroying and breaking up their combat formations. The most efficient attacks on a group of bombers are simultaneous successive group attacks by fighters. In this, the greater the defense fire of the bomber group, the greater is the importance of a group attack on the part of the fighters.

Depending on the conditions, it is recommended that the following three methods of group gunnery be employed: with individual aiming and independent determination of the moment of firing; at the command of the leader with individual aiming by every pilot; at the command of the leader without individual aiming (with automatic time delay setting of the time fuze by the radar range-finder).

Group gunnery with time-fuzed rocket missiles with individual aiming and independent determination of the moment of firing is carried out in the same way as firing with cannon. A specific target is pointed out to every pilot in such a way that the trajectories of the simultaneously attacking aircraft do not cross. The pilot fires independently, which makes possible more accurate aiming.

The shortcoming of this method is time straggling of the missiles' explosions. This has, especially in firing at minimum ranges, undesirable moral effects on the attackers, since they are forced to pass directly through the region of missile explosions. At high altitudes, where the fragments scatter rapidly over large distances from the point of explosion, no danger exists for the fighter aircraft. At low altitudes, travel through the explosion zone following a volley of time-fuzed rocket missiles is undesirable in view of possible fragmentation damage. Therefore, group firing with independent determination of the moment of firing can be recommended only for high altitudes as well as for attacks at low and medium altitudes, provided that firing takes place at ranges of 1000 m or more.

Group firing at the leader's command with individual aiming is characterized by the simultaneous character of the volley fired by the entire attacking group. This enables the group to approach the target at minimum ranges (600-800 m) and after the volley to employ vigorous maneuvers to bypass the region of greatest fragment saturation, particularly at low altitudes. Experience shows that this firing method gives good aiming accuracy with sufficient training and experience in formation flying, especially in attacks at small angles-off which prove to be most advantageous when employing time-fuzed rocket missiles.

The entire maneuver for taking up the initial position and going into the attack is carried out by the group simultaneously in a single combat formation. The leader takes the group to the target and, upon conclusion of rough aiming, gives the order "Get ready!" Following this command the pilots in train, as well as the leader, commence aiming — each on the targets which were assigned to him previously. After precision aiming (this takes 6-8 sec) the leader gives the order: "Fire". The group fires simultaneously and breaks off the action with a vigorous maneuver.

Group firing at the leader's command can be recommended for various attack conditions; this is the reason why it is the principal method of firing time-fuzed rocket missiles. Its successful employment must be preceded by training.

Firing of time-fuzed rocket missiles at the leader's command without individual aiming produces high effectiveness only with automatic delay setting by the radar range-finder. This method is recommended for pairs of fighter aircraft. During the attack, the leader of the pair takes accurate aim at the bomber aircraft, and the wingman concentrates his attention on maintaining close combat formation (sharp "bearing" with a distance between the aircraft of 40-80 m). Upon conclusion of accurate aiming, the leader gives the command: "Fire!" After this command the pair fires a volley.

In view of the fact that the time delay is introduced into the fuze automatically, reliable range aiming is insured. The wingman's firing errors, due to inaccurate aiming, are very insignificant if he is capable of maintaining good combat formation. The important thing here is for the wingman, repeating the evolutions of the lead aircraft, to keep a small distance between aircraft axes during the attack.

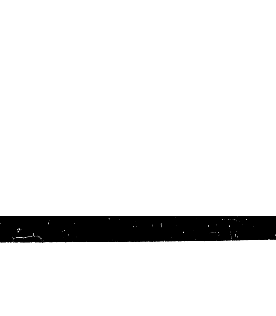


Fig. 1. Versions of attack on a group of bombers by fighter aircraft at the leader's command employing automatic setting of the time delay in the fuze of a time-fuzed rocket missile.

Experience shows that firing by a pair with experience in formation flying yields good results; the effectiveness of the wingman's gunnery is 75-80% of the leader's effectiveness.

This method can be successfully used for destruction of the most important targets — above all of the leading bomber aircraft.

Figure 1 shows two versions of group firing at the leader's command without individual aiming. In the first case a fighter pair is attacking a flight of bombers, directing the main attack at the flight leader. In the second case, the bomber flight is under simultaneous attack of a fighter flight element with two methods of firing in use. The flight commander and the senior pilot, in close formation, fire on the lead aircraft at the command of the flight leader, while their wingmen fire at the same command at the bombers in trail using individual aiming.

This firing method permits an efficient increase in the composition of the group engaged in a simultaneous attack; hence, it permits an increase in the overall effectiveness of the attack.

Let us consider the firing methods employed by single fighter aircraft using time-fuzed rocket missiles.

The fighter can fire rocket missiles individually or in a volley. Calculations show that a volley of two missiles is little inferior in effectiveness to two aimed individual firings. If the fact is taken into account that the fighter must remain in the firing position longer to fire two shots, and as a rule be subjected to fire from the bombers, it becomes obvious that in most cases a volley of time-fuzed rocket missiles is more profitable.

"Our planes are returning!" says technician Lt. V. Ostrikov (left) watching descending aircraft, to his friend, Senior Lt. V. Kudryavtsev. Officers Ostrikov and Kudryavtsev are both Komsomol members and are topnotch in combat and political training.

Photo by G. I. Makarov

One of the important problems of combat employment of time-fuzed rocket missiles against bomber groups is selection and allocation of targets. In solving this problem the possibility of a fragment's damaging not only the aircraft directly under fire but also those next to it in formation must be taken into account and the degree of tactical importance of individual targets must be estimated. Correct choice and allocation of targets between the fighters can increase effectiveness of the attack by 20-30%.

Evaluation of the effectiveness of firing on bomber groups flying in various combat formations shows that the group suffers the greatest losses when first of all, the lead aircraft of flights and squadrons and the aircraft in trail closest to them and on the inside are subjected to fire; in all cases it is desirable to fire upon aircraft located in the line of sight. Firing on lead aircraft and those in trail closest to them and on the inside is advantageous because they are inside the combat formation and, in case of a possible deflection of the missile, the probability of hitting neighboring aircraft is increased. In firing at aircraft located in the line of sight, errors in explosion range are compensated by an increase in probability of hitting a target flying before or after the aircraft directly under fire.

Front-line fighter aircraft have,

in addition to unguided rocket missiles artillery armament which can be used simultaneously with the rocket missile.

Firing of cannon and rocket missiles in one attack can proceed in three ways: cannon and rocket missiles simultaneously; rocket missiles with subsequent switching of the sight over to "cannon"; cannon with subsequent switching of the sight over to "rocket missiles". Simultaneous firing of cannon and rocket missiles is accomplished by switching the sight to "cannon" or "rocket missiles". However, this method of firing at aerial targets is not recommended because of the great difference in ballistic characteristics of artillery projectiles and rocket missiles, whose trajectories lie lower by 20-30 m and more.

The considerable difference in the time of travel of rocket missiles and artillery projectiles also results in considerable error in the lead angle. This method can be used with greater effect in attacks on linear ground targets.

In an aerial combat with bombers simultaneous firing should be recommended only to combine a volley of time-fuzed rocket missiles with an aimed burst from cannon. Here the sight is switched to "cannon", aim is taken at specific aircraft (it is better if the aircraft is in the upper part of the combat formation), and the volley of time-fuzed rocket missiles is intended for exerting moral pressure on the crews and for breaking up the enemy's combat formation. Such firing is recommended for the initial period of attack.

In successive firing of rocket missiles followed by cannon (or vice versa) with corresponding switching of the sight, the fire power of the fighter can be used with maximum effect. If the attack is launched at ranges at which firing of rocket missiles is still possible, the total damage effect of the two methods of successive firing is about the same. However, firing cannon first — and then rocket missiles — has its advantages. It permits the employment of time-fuzed rocket missiles with maximum effect, and hence a more rapid breaking up of the enemy's combat formation. After this task has been completed, other fighters can fire rocket missiles even at the beginning of the attack, and later fire cannon, making approaches at minimum ranges and with maximum utilization of artillery fire.

In aerial combat with bomber groups possessing weak defense armament or totally lacking it, it is most advantageous to fire volleys of rocket missiles at the beginning of the attack. In this case the task of breaking up the bomber combat formation is accomplished with considerable success by fighter attacks at short ranges with maximum utilization of artillery fire.

Fighter combat formations engaged in firing time-fuzed rocket missiles, should not differ from those used for group firing of cannon. However, when the fighters intend to fire rocket missiles from ranges of 600-800 m, it is very important that the combat formation of the simultaneously attacking group be small in depth. A combat formation considerably extended in depth leads to an increase in the range of fire for the aircraft in trail and in isolated cases the lead aircraft can be hit by fragments of rocket missiles fired by the aircraft in trail.

The combat formation "bearing" with a distance between the aircraft of not more than 60-100 m is recommended for simultaneous attacks by a pair firing rocket missiles at minimum ranges. Simultaneous attack by a flight is carried out better in the "wedge" combat formation with an overall depth of not more than 150-200 m. At long ranges in a sharp combat formation, bracketing of one's own aircraft by the

radar range-finder is possible.

The distance between pairs attacking in succession should be set in accordance with the method and order of firing as well as with the rate of closure with the target, the size of the bomber combat formation, and the number of aircraft in it. It also depends on the type of range-finder used by the following group.

When optical range-finders are used in successive attacks by pairs (or flights) against small bomber formations, i.e., when the fighters attacking in succession must aim at the same targets, the distance between pairs must be approximately equal to the firing position (the latter is determined from the moment of commencement of aiming to the moment of breaking off the attack). The magnitude of the firing position, as is known, depends above all on the range sweep for which the sight is designed, and is usually between 800-1200 m. At such ranges the successive group can conduct aimed fire without suffering interference from the preceding group. The first group has time to retreat to a sufficient distance from the target at the moment of commencement of firing by the successive group.

When radar range-finders are used, the distance between subsequent attacks must be increased in such a way as to have the preceding pair out of the bracketing zone of the radar-range finder at the moment of aiming by the successive pair (Fig.2). This zone usually does not exceed 15° (from the aircraft axis). The radius r of the radar range-finder bracketing zone depends on the distance to the target D, the angle of the bracketing zone, and is equal to the product $r = D \tan \phi$. With an angle $\phi = 15^{\circ}$, the radius of the bracketing zone at a distance of 800 m is equal to 220 m, at 1000 m it is 270 m, at 1200 m it is 320 m, and at 1500 m it is 400 m.

A fighter aircraft breaking off the attack at a speed of 900-1000 km/hr requires not more than 5-7 sec to escape the bracketing zone to the side (with an average acceleration force of not less than 2). Consequently, when using radar range-finders, the distance between successive attacking pairs must exceed the size of the firing position by an amount equal to that by which the successive fighter group will approach the target during the time of exit of the previous group from the target bracketing zone. This value is equal to the product of the mean rate of closure and the time required for withdrawal to one side in breaking off the attack (5 to 7 sec). With a rate of closure with the target of 200 km/hr the latter amounts to 250-350 m.

In the case under discussion, the distance between successively attacking pairs (or flights) of fighters must be established in accordance with an extent of the firing position equal to 1000-1500 m.

When fighter pairs (or flights) make successive attacks on a bomber squadron flying in a "wedge" formation, i.e., under conditions when the successive groups can aim at different targets, the efficient distance depends on the method and order of firing.

If, for instance, the second pair of fighters intends to fire rocket missiles at the beginning of the attack, the

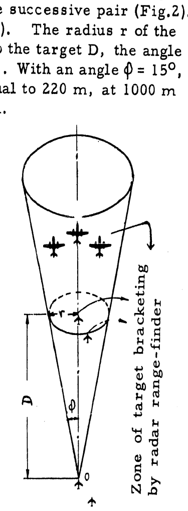


Fig.2. Diagram of target attack by successive groups employing radar range-finders.

distance between pairs is determined, as in the previous case, by the type of range-finder used. If, on the other hand, the second pair intends to fire rocket missiles from minimum distance on the command of the leader at the end of the attack, the distance between pairs can be decreased when optical range-finders are used.

The smallest distance is equal to the distance by which the successive group will approach the target in the time necessary for the preceding group to move off to the side by 300-400 m, in order to avoid being hit by explosions of the time-fuzed rocket missiles.

At a fighter speed of 900-1000 km/hr, 6-7 sec are quite sufficient; therefore, the minimum distance between pairs must be numerically equal to 6-7 times the rate of closure. For instance, if the rate of closure is equal to 50 m/sec, the distance between pairs can be reduced to 300-350 m.

Successive attacks in a combat formation from great distances will lead to an increase in time between attacks, will impair fire cooperation between the attacking fighters, and will make it easier for the bombers to repel their attack.

Successive attacks at reduced distances will put the next group of attacking fighters in a difficult position, since this distance will not permit the group to conduct aimed fire, particularly with rocket missiles, whereas the fighters themselves can be under the fire of the bombers.

The greatest errors in firing time-fuzed rocket missiles are caused by inaccurate estimates of the range and by the delay setting in the fuse. Therefore, radar range-finders should be used whenever possible for range measurements. In using an optical range-finder, the fighter pilot must put the determination of the range above everything else. For this the pilot must learn to identify the target easily and know thoroughly its dimensions in order to have an accurate base.

One of the errors during firing of time-fuzed rocket missiles is firing from a great distance which exceeds the rated capabilities of the sight. With such an error and with automatic delay setting, the missiles explode far short of the target. With manual delay setting, range straggling of bursts increases sharply and the effectiveness of the use of time-fuzed rocket missiles declines. Fighter pilots must know well the sweep of aiming ranges for which the sight is designed under various operating conditions and for various missile ballistic characteristics.

A thorough study of the sight and the peculiarities of firing rocket missiles will increase the level of fire preparedness of fighter pilots.

BOMBING UNDER ADVERSE WEATHER CONDITIONS

Lt. Col. A. M. KHALYAVIN
Maj. YE. F. MURATOV

The success of bombing by means of radar when the ground is not visible depends to a considerable extent on the efficiency and teamwork of the crew, and above all on the cooperation between the plane navigator and the radar operator. Modern sights make it possible to bomb either with preset wind data or without them. However, the setting of wind data into the sight considerably facilitates sighting and improves the quality of bombing. Therefore, proper gauging of wind in flight is of great importance.

In our unit the radar operator determines the wind since he has the opportunity to follow continuously the radar check point on the control leg and to pick out the most characteristic radar check points for computing the course angles (KU) and the slant ranges (ND) to them on the control leg. Use of a variable scale reduces the error in determining the ND and KU of the check point selected. It is difficult for the plane's navigator to combine wind gauging with the operations and calculations of navigating.

During the preparations for bombing we use pilot balloon data on the wind and forecasts of winds at various altitudes. The pilot balloon data on wind should be received no later than 2 hours before bombing. Sometimes they are reported to us by radio just before bombing.

In bombing missions we do not put off determination of the wind until the control leg, which is as a rule chosen not far from the target (150-200 km). After the required altitude has been attained and the regime of horizontal flight established, we immediately proceed to the performance of this task, which is especially important in level bombing on the range or under combat conditions.

On the control leg near the target, various enemy AA defense facilities may make it difficult to maintain the assigned regime of horizontal flight necessary for determining wind. In such cases, the crew will have to use for bombing the wind data obtained on one of the legs of the route. It is necessary to take into account the fact that data for wind calculation cannot be determined without considering the weather situation, since the wind changes direction and velocity on different legs of the route. In preparing for the flight, therefore, we analyze the distribution of air currents at the flight altitude on the basis of topographical pressure maps and select control legs for gauging the wind in such a way that the wind forecast on them

Fig. 1. Grid for computing ground speed and angles of drift.

coincides approximately with the direction and velocity of the air currents over the target.

In our opinion, the most accurate and easiest method of determining the wind in flight by means of a radar sight is by taking two bearings on a radar check point located off the line of flight. For measuring wind by this method, a plainly visible check point — if possible, not too large — is usually selected. Check points of large area change their configuration when the course angles to them change. This introduces considerable inaccuracy in the computation of the KU [course angle] and the ND [slant range] which leads to errors in computing the ground speed and the angle of drift. The error in determining the ground speed depends on the distance traveled between computations, and the shorter this distance the greater is the error. Therefore we take a time base between computations within the limits of 5-8 minutes of flying time. Its magnitude is limited by the visibility of the radar check points. The shorter the distance between the first and the second computation of the KU and ND of the radar check point, the greater is the error in measuring the angle of drift.

In flying over a locality with a large number of uniform radar check points, there is a danger of making the computation for the second determination of the KU and ND from an entirely different check point that resembles the first. To exclude the possibility of such instances, the radar operator constantly follows the radar check point selected for measuring the wind or chooses a reliably recognized reference point.

The data obtained from the IKO [PPI] of the sight are processed by the navigator or the radar operator on a grid for determining ground speed and drift angle. This grid is made on a scale of 5 km to 1 cm and makes it possible to compute W [ground

Fig. 2. Determining W and US by twice measuring the distance to the check point on the course line or close to it.

speed] and US [drift angle] more accurately than with a wind computer. Slant ranges are converted to horizontal distances by the graph attached to this grid (Fig. 1).

On some flights we find W and US (for computing wind) by twice measuring the distances to the check point on the course line or near it (Fig. 2), or by two aircraft position markers (Fig. 3).

The accuracy in determining the wind by the methods described is quite satisfactory for bombing with the automatic sight. To verify the data processed by the sight after the wind is set into the computer, the navigator refines the angle of sighting and the angle of drift, performing synchronization and cross trailing by a radar checkpoint on the control leg parallel to the bomb run or directly on the bomb run. By the sighting angle obtained from the navigator, the radar operator computes the ND for releasing the bomb and sets on it the computer marker for checking bombing range.

The slant range is computed by the formulas:

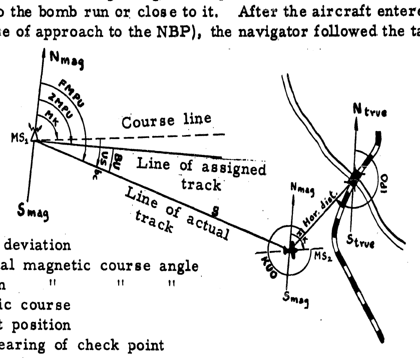
$$ND_{rel} = \frac{H}{\cos\phi^{o}} = H \sec\phi^{o}$$

or on the NL-10 [navigator's rule]:

$$\frac{\sin(90^{o} - \phi^{o})}{\begin{array}{c|c} & \nabla \\ \hline H & ND\,? \end{array}}$$

Strongly affecting the accuracy of bombing is the calibration of the sight; it should be accurately adjusted just before bombing. In bombing under range conditions, the radar operator checks the "zero altitude" and the "5:1" and "6:1" 'frequency divider before each bomb run. Then he sets the antenna in forward coverage and the scale on the IKO within 30 km. Having set the work selector switch on "calibrate", the radar operator turns the computer marker on an "ND" (by using the slant-range drum) equal to twice the bombing altitude plus 2 km and informs the navigator that the calibration of the search part has been completed and that the sight is ready for the calibration of the sighting part.

The entry onto the beginning of the bomb run (NBP) is one of the most important stages in flights for bombing with the radar sight under adverse weather conditions. The approach to the NBP and to the target is made, as a rule, from a characteristic check point; but if there is no such check point (or if for tactical reasons it is inexpedient to pass over it) then the approach to the target can be made by turning the aircraft on a precomputed target course angle (KU_t). We have used this method in approaching large-scale, plainly visible tactical targets when the bomb run was precisely prescribed and when the bombing was done by corner reflectors on bombing ranges. We brought the plane to the area of the target with a deliberate deviation of 40-60 km to the side of it (the magnitude of the deviation depends on the distance at which the target blip is visible on the IKO scope). Spotting the target at a distance of 100-120 km, the navigator gave the pilot the command to turn onto a course perpendicular to the bomb run or close to it. After the aircraft entered the MK_{app} (magnetic course of approach to the NBP), the navigator followed the target blip on



[BU = lateral deviation
FMPU = actual magnetic course angle
ZMPU = given " " "
MK = magnetic course
MS = aircraft position
IPO = true bearing of check point
KUO = check point course angle
US_{bc} = angle of drift on bomb course]

Fig. 3. Determining W and US by two aircraft position markers.

the IKO and, at the moment it reached KU_t [course angle of target], gave the command to turn onto the bomb run. The course angle for the beginning of the turn to the target is determined by the formula:

$$KU_t = BMK \text{ [bomb run magnetic course] } - MK_{app} \pm \alpha ,$$

where α is the correction for the radius of turn of the aircraft (α will have a plus sign when the target is situated in the left half of the IKO scope and a minus sign when it is in the right half).

The α correction is computed on the ground during the preparation for the bombing mission. Its magnitude depends on the true flying speed, the angle of bank β in the turn, the length of the bomb run S_{br}, and the angle of approach to the bomb run.

We will present an example of computing KU_t, taking α into consideration.

$$BMK = 90^\circ; \quad V_{true} = 800 \text{ km/hr}; \quad \beta = 20^\circ;$$

$$S_{br} = 50 \text{ km}; \quad MK_{app} = 0^\circ; \quad \alpha = ?; \quad KU_t = ?$$

$$R = \frac{V^2}{g \tan\beta} = 14 \text{ km}; \qquad LUR = R \tan\frac{UR}{2} = 14 \text{ km};$$

$$\tan\alpha = \frac{LUR}{S_{br}} = 0.28; \qquad \alpha = 16^\circ; \quad KU_t = 90^\circ - 16^\circ = 74^\circ.$$

[UR = turn angle; LUR = turn angle to left]

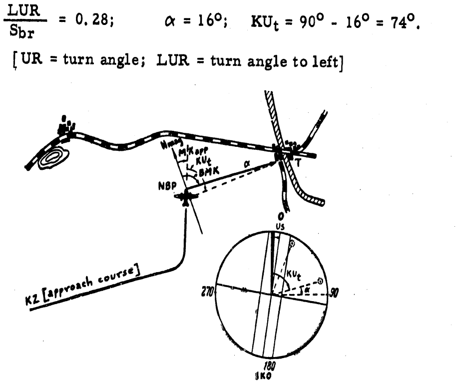


Fig. 4. Method of turning the aircraft onto the bomb run on the course angle of the target (KU_t).

In flight, it is convenient to use a table of corrections for the turning radius of the aircraft for given conditions of approach to the target. Usually the speed, the bank of the aircraft, and the length of the bomb run are known in advance and remain practically unchanged in flight. The table should contain only the angle of approach to the bomb run, which is equal to BMK [bomb run magnetic course] $\pm$ MK_{app} and the α correction.

For example, for $V_{true} = 800$ km/hr; $\beta = 20^\circ$; and $S_{br} = 50$ km, the table would appear as follows:

$BMK \pm MK_{app}$	60°	70°	80°	90°	100°	110°	120°
α	9°	11°	13°	16°	19°	22°	26°

For taking into account the angle of drift on the bomb run prior to the beginning of turn, the operator sets the course line of the IKO light filter at an angle equal to US_{bc} (US_{bc} is the angle of drift on the bomb course). As the aircraft comes out on the computed KU_t the pilot begins his turn at the command of the navigator or radar operator.

During the entire turn the navigator and the operator watch the movement of the target blip on the IKO scopes and, comparing the course angles to the target with the compass readings, give the pilot commands for increasing or decreasing the bank in such a way that at the moment the aircraft comes out of the turn the magnetic course is equal to the bombing course. If the course angle of the target changes more rapidly than the compass reading, the bank of the aircraft is reduced; and, conversely, if the course angle of the target changes more slowly than the magnetic course, the bank is increased, in an attempt to gain a position where the course angle of the target and the difference BMK - MK (MK is the magnetic course at the moment of cross-checking the readings) are equal in magnitude and change uniformly during the course of the turn.

Bringing the aircraft out on the bomb course is analogous to bringing it out on a landing course by the OSP [ILS] system. During the entire turn to the target, the radar operator takes readings of the course angles to the target on the IKO and reports them to the pilot, for whom they replace the readings of the ARK [automatic radio compass] needle. This facilitates intercepting the bomb course when there is no characteristic radar check point at the beginning of the bomb run.

The principal task of the radar operator in bombing with the radar sight is that of making the target blips on the IKO scope clearly visible for the entire course of the bomb run.

In bombing on a range, we achieved this in the following manner. At the beginning of the aircraft s turn onto the bomb course, the radar operator raised the antenna to the maximum, and about 15° -20° prior to entry onto the bomb course lowered it to 5-8° and switched it to sector rocking. This procedure of antenna operation provided excellent visibility of the target on the IKO scopes during the progress of the entire turn. At the moment of changing from a regime of preliminary synchronization to basic synchronization at a flying altitude of 10-12 km, the tilt angle of the antenna was within 10-12°, while at the moment of releasing the bomb it reached 15-18°.

In the process of flying from the NBP to the moment of bomb release, the radar operator periodically reported to the navigator the slant ranges to the target, its position relative to the course line and the sighting marker, and also advised the navigator of changing over to the sight, the beginning of the safe release zone (under range conditions), release of the bombs (arrival of the target at the ND of release), and the end of the safe release zone.

The slant ranges when changing over to the sight and of the beginning and end of the safe release zone are computed in advance in the preparations for flight and are determined in relation to the bombing conditions and the size of the range.

Such a procedure of operation and cooperation between the navigator and the radar operator in bombing with a radar sight under adverse weather conditions facilitates better execution of the mission and reduces repeat approaches to a minimum.

Returning from night flights
Photo: T. N. Mel'nik

LOW-ALTITUDE BOMBING

1. Target approach

The success of low-altitude bombing depends to a great extent on the accuracy of the approach to the target. If the aircraft approaches the target inaccurately, it is necessary for the crew to execute an additional maneuver in order to carry out its mission.

On the basis of our own experience we would like to tell of the peculiarities encountered by our crew while carrying out route flights and bombing in winter and summer, under normal and adverse weather conditions.

Naturally, the carrying out of low-altitude flights is bound up with the constant observation of ground check points, and therefore it is necessary to devote great attention to questions of visual orientation. In order to picture better and more easily the peculiarities of low-altitude air navigation, we shall point out the range of visual detection of check points and the time at the disposal of the navigator for identifying them. With good clear air at an altitude of 100-200 m over level terrain it is possible to detect various check points at a distance of from 15 to 25 km, whereas it is impossible to recognize any additional details (river bends, crossroads, distinctive forest edges, etc.) at such a distance. From such distances churches, factory chimneys, etc., by means of which it is possible to identify a check point, are distinctly visible. From the above-mentioned altitude it is possible to determine the distinguishing features of populated points (district centers, large villages) at a distance of up to 10-12 km.

In carrying out low-altitude flights, particularly under winter conditions, one should not count on large ranges of target detection or on distinctive check points. Therefore, preparation for these flights should be carried out with particular thoroughness. Before each bombing sortie we studied in detail the flight route, its turning points and the areas of distinctive control check points. Usually we took the following maps: a basic flight map with a scale of 1:1,000,000 and maps with scales of 1:200,000 and 1:500,000.

The map with the 1:200,000 scale is used in all cases when it is necessary to determine (identify) some small check point or to carry out an approach to a small-scale target, of which there are many in the course of coordinated action with ground troops.

In order to facilitate target spotting, the target approach leg of the flight route (transferred from the map with the 1:1,000,000 scale according to characteristic points) is plotted on the map with the 1:200,000 scale. Twenty-five-kilometer markings, made beforehand for the simplification of dead reckoning, are also indicated on this segment. The reading of these markings on all legs is begun from the turning check point.

A thorough study of the flight route and a proper preparation of the flight map make it possible for the crew to spend the minimum amount of time on the visual checking of the route, since both the pilots and navigators picture to themselves mentally the sequence of check points along the prescribed flight route. For dead reckoning and for determining the position of the aircraft we make extensive use, in addition to visual observation, of the navigational, barometric, radio and radar instruments installed in the navigator's compartment.

Magnetic compasses are used just as in ordinary flights. I would only like to point out that in preparation for low-altitude flights it is necessary to pay particular attention to magnetic anomalies in the area of the forthcoming flight. True, it was not necessary for us to fly over such regions, but the experience of other crews shows that the strongest influence of magnetic anomalies on compasses extends to altitudes of 1500 m. Therefore, while flying over a zone of magnetic anomaly it is necessary to switch to air navigation by means of ground check points, and to stay on course with a previously compensated GPK [directional gyrocompass] and by using the astrocompass when possible.

If anomalies are ignored along the flight route, one may find himself in a difficult situation which may even result in loss of orientation.

The ARK-5 [automatic radio compass] radio compasses are used just as in medium and high-altitude flights. The difference consists only in the radius of their possible use. The barometric instruments — the VD-20 [air pressure] altimeter and the KUS-1200 airspeed indicator — were used as usual. The high-altitude ratio altimeter was used in all flights. The quality of reception of the reflected pulse up to an altitude of 50 m and higher was good. Altitude reading is simple and convenient; a reading accuracy of within 5 m is possible.

The NI-50 B navigational indicator was used in all flights without exception for checking the course and for determining the wind. The wind was determined by cross-checking the aircraft's no-wind coordinates furnished by the indicator and the actual markings of the aircraft's position.

On the basis of flights carried out by us, it is possible to say that, in view of the negligible magnitude of the wind near the ground, there is practically no need for measuring it. Of course, if the wind reaches 30 or more kilometers per hour it is impossible to disregard it, since under such conditions the drift of the aircraft at speeds of 500-700 km/hr is more than 2-3^{o} and the failure to take it into account may lead to considerable lateral deviation.

The crew has very little time for transition to conducting detailed low-altitude orientation; therefore, the NI-50B meter readings (even the no-wind ones) of the track flown and the special 25-kilometer markings on the map facilitate the execution of this task in the shortest time possible.

The accuracy of the indicator reading is somewhat increased if the value of the longitudinal wind component is set in on the wind input. Thus, during one flight (average MPU [magnetic course angle] = 80^{o}), at the beginning of the flight route I determined our groundspeed from the time and distance traveled. It turned out to be greater than our airspeed by 20 km/hr. On the course input I set the map angle equal to the MPU (80°); on the wind input, the KU [course angle] = 80°; the wind direction "arbitrary", equal to 80°, and wind velocity 20 km/hr (if the groundspeed were less, it would be necessary to set the wind direction opposite to the MPU — in this case 260°).

After the aircraft had flown 350 km, the course line computer showed an error of 5-7 km which was of no practical importance in the determination of the aircraft's position in this area. The accuracy was quite sufficient.

Since in flights over rugged and mountainous terrain a frequent change in the wind is possible, it is advisable tp set the wind velocity at zero on the input.

I would like to draw attention to the fact that the navigator is not always in a position to measure the drift with the instruments at his disposal. In this he should be aided by the rear gunner who, in the absence of severe turbulence, can with sufficient accuracy determine the drift with the aid of his sighting station.

On our plane the rear gunner carried out this task in the following manner. First of all he would lock the sighting station in the direction of the aircraft's longitudinal axis in the horizontal plane. The station would be lifted from the support along the vertical. He would set a base line of 7 m and a range of 200 m on the sight. Then he would switch on the transformer and this would conclude the preparation of the station for measuring drift. Choosing any small check point (a tree, a chimney, an isolated house, etc.) over which the aircraft was flying, he would carry on further observation of it in the field of vision of the sight. As the check point would recede, he would determine the direction of its displacement relative to the central point of the collimating ring. The direction of the displacement of the check point shows the direction of the drift of the aircraft (since the rear gunner faces backwards, he observes the relative shifts of the check points and of the aircraft in reverse), and the amount of drift angle is determined by the angle of the ring. With the data cited above

$$\psi^\circ = \frac{\text{Base in m}}{17 \times \text{Range in m}} \cdot 500 = \frac{7 \cdot 500}{17 \cdot 200} \approx 1^\circ .$$

When the check point has considerably receded from the aircraft, the aerial gunner determines visually how many rings go between the longitudinal axis of the aircraft (the sight is fixed) and the check point under observation. The number of rings in this case corresponds to the number of degrees of drift of the aircraft. Such a method of measurement made it possible to determine the angle of drift with an accuracy of up to 1-1.5°; this is quite sufficient for air navigation and bombing.

While carrying out flights we even devoted attention to such a method of wind measurement as the purely visual observation of surrounding conditions. A particularly distinctive check point for this purpose is smoke rising from factory chimneys, from the smokestacks of standing locomotives, from bonfires in the forest, etc. Of course, it is not possible to determine the wind accurately in this way, but one can get a general picture of the amount and direction of the wind. Estimating how the air movement under observation (by means of the smoke) is "helping" the flight, whether it is decreasing or increasing the groundspeed of the flight and in which direction there is drift (to the left or to the right), it is possible, with sufficient accuracy for all practical purposes, to introduce corrections for the course being followed and for the flight speed. The accuracy of such wind gauging entirely depends on the degree of the navigator's training. Incidentally, such skill is ac-

quired very rapidly.

The most valuable feature of this method is that it does not require any computations. I think that those navigators who will find it necessary to fly at low altitudes will appraise this method of approximate determination for its true worth.

HIS FAVORITE PROFESSION

M. N. Kozhin

Well-deserved prestige is enjoyed at the Air Force school by instructor Lt. Col. M. N. Kozhin. He fervently loves his profession. Thoroughly preparing for his classes, Kozhin conducts them in an interesting and profitable manner. He devotes much attention to the practical training of cadets directly on the airfield, in the cockpit, on the stand and on trainers prepared by him. Kozhin imparts his rich experience as a teacher and methodologist to the others. Communists have put great confidence in him by electing him a member of the Party Bureau. Officer Kozhin has on many occasions received expressions of gratitude from the command for the fine results of his training and education of future pilots.

A radar sight giving a sufficient view of the terrain being flown over at altitudes of 100-200 m was used by us in all flights without exception, both for air navigation as well as for determining the wind. With the presence of good radar check points, the sight to a considerable degree facilitates air navigation and transition to detailed identification of the check points being flown over and of the area of the target.

In view of the fact that the best ranges of detection of radar check points are mainly within 50 km, it is advisable to use a variable scanning scale (10-70 km), extending it to a magnitude of approximately 40-50 km. But if flight over a distinctive check point at a greater distance is anticipated, naturally it is necessary to set the scale at 70 km. It was in practice unnecessary to use a scale of 100 and 200 km at low altitude.

Carrying out flights over steppe regions and using the radar sight, we were able to observe railroads at a distance of up to 30 km on the PPI scope.

Measuring the distance to radar check points located on the radio-range leg, we would immediately obtain a complete picture of the correctness of our maintenance of the prescribed flight route (with respect to heading).

I would like to draw particular attention to the execution of low-altitude flights at night. One such flight was carried out by us at an altitude of 300 m and at a speed of 550-600 km/hr. Weather conditions were as follows: overcast, 10 points; visibility of illuminated check points along the horizon, 35-40 km. During this flight we became convinced that low-altitude navigational conditions are still more complicated at night than in the daytime, even at a lower altitude. What makes them complicated? In the first place, it is impossible to identify check points by their contours and by additional distinctive details (approach roads, small rivers, churches, crossroads near the check point, etc.); in the second place, it is extremely difficult to collate the map with the terrain due to the blinding effect of the light necessary for reading the map; in the third place, when the check point is not illuminated, the range of its detection is reduced to 2-5 km, which does not even allow the minimum time necessary for identifying a check point; in the fourth place, limited visibility actually excludes visual orientation. There are, of course, still other peculiarities which complicate flying, but it seems to me that this is sufficient for coming to the conclusion that the detection of small targets at low altitudes and at high flight speeds is a very difficult task. As the basic instruments for conducting orientation and dead reckoning we used the NI-50B navigational indicator as the course-line computer, and the radar sight for scanning within a radius of up to 40 km the terrain being flown over, depending on the size and radar contrast of the check point.

When check points are not illuminated, it is possible, with the aid of the radar sight, to fly the aircraft to populated centers of approximately regional importance. The range of their detection was within the limits of 25-40 km. Other navigational equipment is used in night flight just as in the daytime.

Such, in short, are the peculiarities of air navigation and of the navigational conditions encountered by a crew while approaching a target at low altitude.

Col. N. S. Zatsepa,
Military Navigator First Class

2. The bomb drop

Low-altitude bombing at high speeds is an extremely complex aspect of combat employment. The main difficulty for the crew lies in the fact that the ground objectives beneath the aircraft shift with a high angular speed, as a result of which scanning of the terrain is greatly reduced. Even under bombing range conditions crews making their first flights spot the target area with difficulty, particularly if observation is conducted through an optical sight.

Our pilots and navigators successfully overcome all difficulties arising during the process of mastering low-altitude bombing. Over extremely rugged and mountainous terrain targets are hit accurately on the run at low attitude, not only by individual aircraft but also by elements.

It is about the experience of our topnotch crews that we would like to say something.

Our training for low-altitude bombing begins with the execution of preliminary complex tasks. The first task consists of approaching the bombing range area at low altitude for the purpose of familiarization with the outline and the visibility of the targets. It should be said that the targets themselves on our bombing range are outfitted with vertical panels 2.5 - 3 m high in the form of a fence. This is done in order to bring the representation of the target closer to actual conditions — indeed, to a crew at low altitude all ground objectives in reality seem not flat but dimensional. The crews fulfill the second preliminary task for the sake of training in sighting with photobombing. As a rule, sighting is accomplished before the landing approach (from altitudes of 500-300 m) with the AP-5 [autopilot] switched off, but with the course stabilizer switched on. To state it differently, the crew turns

the aircraft in accordance with the KIP [true compass bearing].

Only after these preliminary complex exercises have been well executed is the crew allowed to proceed to low-altitude bombing.

In order to hit the target accurately from low altitudes the crew determines the sighting data (US, ϕ) in good time. We recommend making the necessary computations at a distance of not more than 50 km from the target and on a course parallel to the bomb course. The angle of drift (BURP) [lateral deflection of radar sight] is measured in two ways: by the speed at which the ground passes and by the markings of the actual positions of the aircraft.

The dropping angle can be determined by the "cold ranging" method, the essence of which consists in the navigator's measuring the time of traveling the base line (it must correspond to the no-wind or computed dropping angle) under a flight regime corresponding to that of combat and at the true bombing altitude. The stopwatch is set the moment a small check point comes into the cross hairs of the optical sight at a sighting angle equal to ϕ, and is stopped the moment the check point passes the vertical with the gyroscope switched on.

Let us determine the course followed by an aircraft with the time of bombfall

$$S = W \cdot T$$

and bomb deviation

$$S - \Delta = H \cdot \tan \phi = A,$$

from which

$$\frac{A}{W} = t_b, \text{ and } \frac{\Delta}{W} = t\Delta.$$

The time base of the dropping angle, clocked by the stopwatch, plus the time of the bomb trail must be (with a correct dropping angle) equal to the time of bombfall from a given altitude. If there is no such equality, it is necessary to correct the dropping angle.

The relation will be expressed by the formula:

$$t_b + t\Delta = T,$$

in which t_b is the time base of UV [sighting angle], equal to the dropping angle;
$t\Delta$ is the time of flying the bomb trail;
T is the time of the bombfall.

The time of traveling the base line, as we have already said, is measured in the air, but the bomb-trail time is computed on the ground before the flight, assuming that W = V.

If the sum of $t_b + t\Delta$ is greater than T, it is necessary to decrease ϕ; and, vice versa, to increase ϕ if the sum turns out to be less. By how much should ϕ be increased or decreased? By solving a specific example, it is not difficult to convince oneself that a difference of 1 second alters the dropping angle by 1.5 - 2°.

Flights indicate that BURP and ϕ can be definitized simultaneously by the "cold ranging" method, according to a base line equal to the dropping angle. However, it should be remembered that if ϕ, according to which the base line is read, is located within the limits of 60-70°, the US will, in fact, be equal to half of the measured US, and if ϕ exceeds 70°, the US will be equal to 1/4 of the measured US.

The navigator measures the true altitude, as usual, with the aid of a high-altitude radar altimeter. But the pilot, without fail, checks the measurement with a low-altitude radar altimeter. After this the indicated flight altitude, which the pilot maintains on the bomb course, is established.

A few words about the peculiarities of working with an optical sight.

By means of the synchronization knob we set ϕ on the sight at 20° less than computed. For example, if $\phi = 72^\circ$, on the sight ϕ is set at 52°. We set the sighting angle at 70° and increase it by 20° with the aid of the attenuator which we leave switched on throughout the entire bombing. We release the bombs only by means of the automatic release when the UV and ϕ readings coincide, since when the combat button is used for this purpose, additional errors due to delayed reflexes — common to all navigators — occur.

The cross hairs of the sight are laid over the target best of all by using the sighting knob. We do not recommend turning the sighting knob to "bracketing" since as a result of this navigators very often throw the dropping angle off and cause the bombs to fall short.

It is much easier to hold the target in the cross hairs of the sight by switching on the W motor 5-6 seconds before release as recommended in the instructions. Even in light turbulence it is necessary to use the vertical gyro. As a result of failure to maintain horizontal flight with a caged gyroscope, considerable bomb deflections in range are possible. If, on the bomb course the aircraft gains or loses altitude at the rate of 1 m/sec, the dropping angle will decrease or increase accordingly by 1°; this results in a bomb short or over of 100-150 m.

It is necessary for the navigator to watch the longitudinal stabilization bubble of the gyroscope, on the position of which the dispersion of the bombs with respect to range depends, since lateral errors are negligible.

Corrective turns on the bomb course during crosstrailing must be extremely accurate, since at high indicated speeds along the course the aircraft is very stable and, therefore, it is not easy to execute a corrective turn onto a new course.

Such has been some of our experience in low-altitude bombing.

Maj. A. I. Filippov, Military Pilot First Class,
Capt. B. S. Chuvikov, Military Navigator First Class

PERMANENTLY ON THE UNIT ROSTERS

B. V. Panin (1941)

In battles with the Fascist German invaders, an alumnus of the Lenin Komsomol, pilot Boris Vladimirovich Panin displayed courage, bravery and true heroism.

During one flight it was necessary for Panin to photograph an enemy airfield. At an altitude of 5700 m he was attacked by seven enemy fighters. Panin put the aircraft into a dive and flew off to the side of the target. The radio operator informed him: "There is no one behind." But in a few minutes the aircraft was attacked again. The voice of the radio gunner resounded in the earphones: "I got one!" Banking the plane, Panin saw a black trail from the plunging fighter. A little higher the cloud cover was visible. Profiting by the confusion of the Fascist pilots, he put the plane into a climb, turned, and entered the clouds. The enemy thought that Panin had gone. But that is not the way of a Soviet pilot. Panin turned the aircraft and flew it to the reconnaissance objective. "Did the enemy believe that I fled, isn't he waiting?" And here was the airfield. There were no enemy fighters in the air. Having photographed the assigned objective, the scout headed for the east.

On 4 August 1943, while carrying out a combat mission, this fearless pilot died the death of the brave.

By decree of the Presidium of the Supreme Soviet of the USSR, Guards Junior Lt. B. V. Panin was posthumously awarded the title of Hero of the Soviet Union.

By order of the Minister of Defense of the USSR he has been forever entered on the rosters of unit X.

Flights are well organized in unit X. Accurate control, carried out from the command post, here plays an important role.

In the photo: Military Pilot First Class, Maj. I. M. Shcherbo, a master of aerial combat and of sniper fire, at the command post. Photo: G. I. Makarov

A YOUNG PILOT FLIES ON INSTRUMENTS

Lt. Col. D. K. KUDIS
Military Pilot First Class

There is a solid, heavy overcast above the ground. You cannot make out where the lower limits of this grey covering begin. The air is damp and colorless. Looking closely you see torn shreds of clouds floating just overhead; you hardly have time to follow them with your gaze before they merge with the dark grey mass and dissolve into it. And there is not a glimmer of light. A gloomy picture! But pilots think of it differently on a flying day, glad of the nice "pea soup".

Climbing in the air, the weather reconnaissance plane reports to the flight controller the altitude of the cloud base and the thickness of the clouds. But then the metal wings penetrate the dark mass of the clouds and burst into "freedom"; then you see the dazzlingly bright rays of the sun spilling over the snow-white cloud deck, filling the cockpit of the aircraft with warmth and light. And you see the clear and peaceful distances stretching all about.

Having completed his mission, the pilot penetrates the cloud deck and lands.

Instrument flying! It requires great skill, an exertion of moral and physical strength, and systematic training. The phrase "instrument flight" has become customary. However, the flights themselves are not customary for all. The most highly trained pilots feel confident and calm in the clouds. Such confidence comes only when you learn to transfer your attention to the instruments immediately upon entering the clouds, to "read" them correctly and to react in accordance with their readings. Only under these conditions is it possible to form an exact and clear idea of the position of the aircraft in space.

Man, unfortunately, is not adapted to "feeling" the aircraft without seeing the natural horizon; and even more important than this, sensations in such cases may be deceiving. Sometimes they suggest that which is not at all so, and if you do not learn to trust the instruments and to determine the position of the aircraft in space in accordance with their readings, you will not be able to fly.

Pilots intercepting aerial targets often fly for a prolonged period in the clouds, keeping an eye not only on the instruments and the position of the aircraft, but also on the target which is also flying in the clouds. It is possible to spot and attack the target only with the aid of a radar sight. But this is the second, the more advanced stage of fighter training.

Until now among a certain segment of pilots the opinion still exists that not all pilots can fly under adverse weather conditions at night. A natural question suggests itself: Why?

If the pilot flies successfully at night under favorable weather conditions and even in the daytime under adverse ones, and is suddenly found untrained for flying in clouds at night, should not the cause be sought, not in his capabilities, but rather in the errors committed by the instructors during the initial training period?

Flights under adverse weather conditions are a difficult aspect of training. Precisely for this reason it is necessary, during transition to them, to take particular care in considering the individual characteristics of each pilot. Only by knowing well the psychological peculiarities of the trainee is it possible to raise the degree of his training correctly and consistently to the level of a pilot first class.

Nervousness on the part of the most experienced pilot before a flight under adverse conditions is a legitimate feeling. But the more instrument flying he does, the less nervous he is apt to be, and the more confidence he acquires in the successful accomplishment of his mission. In individual instances of flying in the clouds, especially at night, the pilot experiences not only nervousness but also fear. This prevents him from concentrating his attention on the instruments and from calmly sizing up the situation.

Let us take an example. A certain pilot flies well with his instructor in the closed cockpit of a two-place aircraft under ordinary weather conditions. He has completed a program of instrument flights in a closed cockpit, has soloed in the daytime in a thin cloud cover with a high base. Once he was forced to make a landing approach, when the weather suddenly became worse: visibility was reduced to 2 km and the overcast dropped to 200 m. The pilot found himself in what was for him an adverse situation. The flight controller clearly and calmly gave commands from the ground; the pilot acted correctly and landed the aircraft safely. However, it was a hard and painful experience for him. Sharing his impressions and experiences during this flight, he frankly admitted: "I never experienced such sensations while flying under normal conditions at school. I flew like everybody else. In the regiment I used to dream of flying in the clouds and felt proud of the pilots who flew under adverse conditions, with limited visibility, and who could accurately and confidently make their landing computations. I knew that it wasn't easy, and carefully studied the instruments, often practiced in the cockpit of a plane, and prepared myself for flight.

"My first instrument flight in a closed cockpit was very difficult. I distributed my attention among the instruments incorrectly: keeping an eye on the bank, I would not notice a change in altitude; maintaining altitude, I would fail to maintain my course and speed. The second flight was the same. Later I learned to act correctly and received a good evaluation; but I did not have confidence in being able to solo on instruments. I did not admit this to anyone. During my first solo flights I piloted on instruments with comparatively good visibility. Of course, this did not bolster my confidence.

"I understood that, in contrast to the others, I was in need of a greater number of flights with the instructor under varied conditions. When I entered the clouds in a fighter for the first time, I was jumpy; but then I quickly calmed down, since I knew that at any minute I could leave the clouds. And that is what I did.

"When I had to fly above the cloud cover for the first time and I heard by radio that the weather in the area of the airfield had suddenly become worse, I was so alarmed that I thought of using my parachute. True, the thought that I had to handle the flight, that for this purpose I had sufficient practice, proved stronger; but nervousness prevented me from correctly distributing my attention among the instruments. I often made corrective turns, although there was no need for this. I wanted to see the runway more quickly.

"Penetrating the cloud deck, out of confusion I descended to an inadmissibly low altitude, almost to hedgehopping level. Fortunately the plane came out on a line with the runway; but I overshot in my calculations. There could be no question of a go-around, nor did the flight controller insist upon it. Evidently he understood my condition, basing his judgement on my landing approach and profile. When I climbed out of the cockpit I did not even feel ashamed of my fear, but only felt resentment for not having learned earlier to fly under such conditions. But, to be sure, that was up to me. After all, the instructor could not have known my thoughts."

No, in the young pilot's opinion, he could not have known. But is is necessary to know. Many pilots make a big — sometimes fatal — mistake by concealing their doubts, and commanders commit a no lesser one by not studying to a sufficient degree the pilots' mentality and temperament. I am convinced that if this pilot had had a sufficient number of practice flights with the instructor under minimal weather conditions, he would not have experienced such a mental trauma.

It is possible to cite still another, almost analogous, case. The pilot carried out his first flight in the cloud cover with the instructor when the weather was such that the instructor himself encountered difficulties and was able to land the aircraft (with a low overcast and rain) only after a go-around. And the young pilot naturally concluded that if such a task proved to be difficult for an experienced, highly trained instructor, what would happen to him when he began to fly alone and found himself in a similar situation? It is no wonder that for some time he lost faith in his own abilities and mastered instrument flying later than the others.

The cause here lay not at all in physiological deviations from the norm, as the physicians were inclined to think. The experienced commander understood this and now the pilot flies in all kinds of weather, in the daytime and at night, and recalls with a smile his former feeling of fear.

It is too bad that some commanders ignore adverse conditions while flying with young pilots — and not only with young ones! And this leads in the end to a lack of confidence on the part of the pilot in his own ability when he finds himself in a more adverse situation.

Of course, not all young pilots react thus to their first flights in the cloud cover. Each one has his own peculiarities. However, in the initial training stage it is necessary to approach the choice of flying weather with care and not to rely on satisfactory evaluations received for exercises carried out in a closed cockpit. The morale of a pilot is different when he finds himself alone in the clouds than when he is flying with the instructor in a two-place aircraft. This is only natural. It is possible to cite a number of examples in which young pilots, finding themselves in an adverse situation, particularly at night, have confused the instruments, and have incorrectly determined the altitude and attitude of the aircraft. Only self-control and faith in the instrument readings gave them the confidence which is necessary under complicated flying conditions.

I shall cite an instance from my own personal experience. I was carrying out my fourth night flight under adverse weather conditions. In the clouds my ARK-5 [automatic radio compass] failed. Distrust of the remaining instruments immediately set in. It seemed that the course was inaccurate and that the time for approaching the airfield was stretching out too long, and I involuntarily began to doubt the correctness of the radio bearings received while approaching the airfield and the landing course. My state of alarm ceased only when I became convinced of the correctness of the readings of the other instruments. Since that time I check the operation of the ARK-5 on the ground before flight with particular thoroughness.

By this example I do not mean to say that night flying in the clouds involves extraordinary difficulties. No! But it offers convincing proof that it is necessary to prepare thoroughly for such flights, and to develop confidence in the safeness of them in all kinds of weather. If the pilot is calm, self-possessed, healthy, and has practice in piloting an aircraft by instrument, he will always complete every type of flight successfully.

Every fighter pilot must strive to become a pilot first class. If, from the psychological point of view, he is ready for flying under adverse weather conditions and is sufficiently trained, he will fly on instruments with confidence.

To fly without flight accidents is the very first task of every pilot. There can be no flight accidents wherever proper attention is devoted to methodical work, wherever all possibilities are utilized for giving the pilot systematic training in instrument flying, wherever the instructor flying personnel is constantly perfecting its theoretical, methodological, and practical habits and transmits them to its subordinates — here indeed no flight can give rise to doubts as to its outcome.

It would also be possible to speak of the meteorological support of flights and of the serviceability of instruments and equipment, of everything which ensures the organization of a flying day. But all of that, in my opinion, concerns methodical work with people, the level of which depends on the ability of the instructor personnel to organize things so as to eliminate the possibility, not only of flight accidents, but also of their causes.

THE MECHANICAL CONDITIONS FOR THE PHENOMENON OF WEIGHTLESSNESS

Lt. Gen. of ITS [Engineering and Technical Service]
V. S. PYSHNOV, Honored Scientist and Technologist

Before man commenced flying, or while he flew only in air balloons not subject to large accelerations, the impression existed that the magnitude of the force of gravity and the position of the vertical was unchangeable. But even in first flights in aircraft a loss of correct feel for the vertical became evident. In turns with a small bank angle the illusion arises that the aircraft is flying straight and that the surface of the earth is tilted. This illusion can be overcome through training, though it sometimes is felt even by experienced pilots.

In order to fly correctly, pilots have trained themselves to judge the position of the aircraft not by their own sensations but by the position of the aircraft's surface relative to the visible line of the horizon. It is natural that, upon entering cloud cover, the pilot found himself in considerable difficulty; and, after making his exit, some time was required for him to judge in what position his machine was. In a number of cases this lead to difficult and even dangerous moments: dives, nose spins, inverted flying. As a result of the development of the mechanics of blind flight, the pilot was forced to give up completely any feel for the vertical and to orient himself exclusively by the readings of the instruments. It was established that the feel for the vertical is not only independent of the true position of the latter but is mainly formed by the pilot himself, i. e., as a result of the actions of the control elements (elevator, heading, and throttle control).

In making advance maneuvers pilots became acquainted with the illusion of the gravitational force (its direction and magnitude); thus, for instance on sharp turns, at the beginning of a loop, and when pulling out of a dive, an apparent increase in weight by 2-4 times and more was felt. Simultaneously they came across weightlessness phenomena of rather short duration and not sharply manifested, to be sure. Much more marked, but also of short duration, was the sense of weightlessness felt by parachute jumpers in jumps from free and moored aerostats in the absence of wind.

The sensation of weightlessness occurs in flight sometimes quite unexpectedly as a result of turbulence. Cases are known in which aircraft passengers have fallen to the ceiling of the cabin even though the aircraft was in a normal position. With increase in flight speeds, the condition of weightlessness may become more prolonged. In approaching the first cosmic speed, equal to 7.9 km/sec, the duration of the condition of weightlessness increases sharply. The first Soviet artificial earth satellite was in orbit for three months, during which time its weightless condition lasted.

In dealing with new phenomena, familiar methods of analysis are used, and the phenomena are compared with known facts. This has its positive as well as negative aspects. Of course, theoretical principles must always be used. However, theoretical methods may be of little use if they are applied formally. Many examples of this are known in the history of science.

Mechanics is the fundamental science of the motion of bodies. Before the invention of the airplane, it was applied to a considerable extent in the study of motion of celestial bodies and of machine parts. Experience gained in these studies was applied to the study of aircraft and rocket flight. It is known from astronomy that a point exists between two planets at which the forces of attraction are equal and opposite. Consequently this is the point of weightlessness. So reasoned Jules Verne in his novel "From the Earth to the Moon" and made an error in ascribing the sensation of weightlessness in the projectile to the moment of transition through this point.

In studying the motion of machine components, the concept of centrifugal force was used. D'Alembert's principle which was applied to this is as follows: "If a body is made motionless and if we add to the effective forces the forces of inertia which are equal to the product of the body's mass and the acceleration of its motion and which are directed opposite to the acceleration, we will obtain a state of equilibrium." From this it is clear that the forces of inertia are conditional. Application of d'Alembert's principle simplifies in a number of cases the study of problems in strength of materials, stresses applied to supports and other problems, if the nature of the motion is well known, as it is, for instance, in the motion of a mechanism with sufficiently rigid connecting members. Obviously we cannot apply d'Alembert's principle if the nature of the motion is unknown, which is true in the study of aircraft flight. It cannot even be applied to mechanisms in which the connecting members are deformed or the supports are displaced.

Explanations of the condition of weightlessness are very often based either on a case when there is no force of attraction or when there is an equilibrium between the acting forces of attraction and the centrifugal forces of inertia.

The first situation insures weightlessness, but is not absolutely necessary. Equilibrium between the acting forces and the inertial forces provides weightlessness only in a case when the former are forces of mass distributed throughout the elements of the body. But then there is no necessity of applying the forces of inertia.

The questions of weightlessness, apparent weight, and the apparent vertical may quite conveniently be studied in the following way. Sensation of weight is connected with transmission of forces within a structure or a living organism, i. e., by means of loads, pressures, or internal stresses. Thus the source of apparent weight is in the local conditions or pressures which subsequently must be transmitted to all parts of the body. If such localized stresses are absent, a condition of weightlessness will result. Take for instance, a man standing on the floor. The sensation of weight is determined by the fact that he is supported by his legs and this support is transmitted to all parts of his body. Should the support, i. e., the floor, suddenly collapse, a condition of weightlessness will occur.

Second example: in a flying aircraft, the lifting force is applied to the wings, the thrust, to the propeller or jet engine; the resistance is distributed over all parts located in the air flow; and the force of gravity, over all parts of the aircraft, regardless of their function. As a result, the lift, thrust, and head resistance will be transmitted through the structure to all parts of the aircraft proportionally to the value of their mass. Let us assume that a body — for instance a pilot — is in an aircraft and his mass is 1/50 of the aircraft mass. Then 1/50 of the lift Y, the thrust P, the resistance Q, and side force Z in slipping will be transmitted to him. As far as the forces of gravity are concerned they will not be transmitted. The sensation of weight will be determined by the ratio of the resultant forces Y, P, Q, Z, and the force of gravity, and the apparent vertical will be directed along this resultant.

It can easily be seen that the direction of the resultant is independent of the true vertical, and it is for the pilot to influence the magnitude and direction of forces (lift and thrust) in order to bring the resultant into the vertical position and make its magnitude equal to the weight. In this case the flight will be rectilinear and uniform (Fig. 1a).

As soon as the pilot, by pulling the stick toward him, produces a lift greater than that required to fly in a straight line, a feeling of acceleration will appear and the position of the apparent vertical will change (Fig. 1b). In banking the aircraft, the lift will tilt with the wing, and with it will tilt the apparent vertical. If the thrust is sharply decreased, the apparent vertical changes its position (Fig. 1c). From this

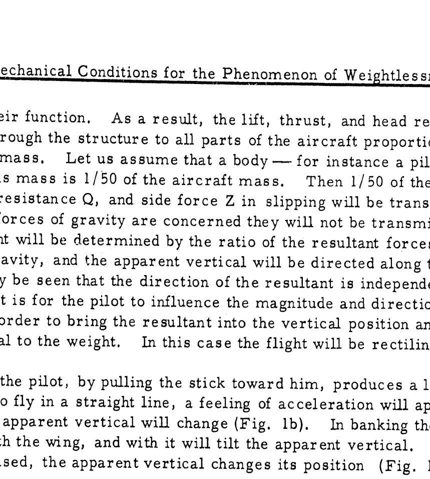


Fig. 1. A diagram for calculating the position of the apparent vertical: a-horizontal steady flight; b-start of maneuver; c-horizontal flight with braking.

it follows that the location of the apparent vertical in reference to the aircraft depends only on the ratio of the lift, resistance, thrust, and side forces (in slipping). Since the magnitude of these forces is influenced by the speed of flight and the actions of the pilot, the apparent vertical cannot serve as a direct indication of the aircraft's position.

If the elevator is set so as to put the aircraft at an angle of attack corresponding to absence of lift, and the amount of thrust is such that it balances the force of resistance, we obtain a resultant force equal to zero, and a condition of weightlessness will result. Thus the prerequisite for weightlessness is absence of local stresses which must be transmitted to other parts of the body. A condition of total weightlessness is rather difficult to simulate, while a condition of partial weightlessness is quite easy to simulate. If a chair were to be manufactured to follow the contours of the human body, sitting in it would produce a state close to that of weightlessness. This condition is even easier to achieve by immersion in water, especially if the latter has a density equal to the density of the human body. The required density of the water can be obtained by dissolving in it a definite amount of salt. However, the above-mentioned methods do not produce a condition of weightlessness for the internal organs; hence orientation in space is retained.

Fig. 2. Diagram of flight under a condition of weightlessness.

Weightlessness can be felt in jumping from an aerostat, but for a limited time only, so long as the speed of fall is negligible and, consequently, air resistance is slight. In jumping from an aircraft no state of weightlessness results, since a man is acted upon by local pressures in the air stream. As for the apparent vertical, it is directed along the effective line of resistance. How long can a condition of weightlessness last during an aircraft flight? If the choice of angle of attack and engine thrust results in a condition of weightlessness, the motion of the aircraft is analogous to the flight of a body in a vacuum and is determined only by the force of gravity. As is known, the flight path in this case is a parabola*. To lengthen the flight along the parabola, the flight must be begun on the ascending branch. Assume that, as a result of a maneuver, an aircraft flying at high speed started a steep climb (Fig. 2). At a certain velocity close to maximum in horizontal flight thrust will balance resistance and, after lift is eliminated a condition of weightlessness will occur. This will last until the aircraft returns to the original altitude along the descending branch. The duration of weightlessness can be found very easily. Let the velocity at the initial point be V and the slope of the flight path be θ; then the vertical velocity will be $V_y = V \sin\theta$. The time of climb to the apex of the parabola is $t_1 = \frac{V_y}{9.8}$ and the time of descent is identical. We finally obtain

$$t = 2t_1 = 2 \cdot \frac{V \sin\theta}{9.8}.$$

It would seem that with an increase in the angle θ the time should increase. But this is not so. In commencing a sharp climb a drop in velocity will occur. Ap-

*More accurately this will be a motion in an ellipse. Motion along a parabola is considered only for short ranges of flight, when the curvature of the earth's surface can be neglected.

parently the optimum angle θ will be approximately equal to 45° - 60°. With a sharp climb an undesirably rapid turn of the aircraft will occur at the apex of the trajectory By assuming different velocities V and taking $\theta = 45°$, we obtain from the formula t = 0.29 V the following values for the time (see table).

V m/sec	100	200	500	1000
t	29 sec	58 sec	2 min 25 sec	5 min

Consequently a condition of weightlessness can be observed in a modern aircraft for a period of 1 - 2 min. To prevent a disruption of this condition, it is advisable to install a special autopilot to control the angle of attack and the magnitude of engine thrust, while the flight should take place in the absence of wind. The greater the flight speed, the longer may a condition of weightlessness exist.

Let us consider in sequence the sensations of a passenger flying in a ballistic rocket. At the moment of takeoff upward along the vertical (Fig. 3a), the rocket is heavily loaded with fuel, and in spite of great thrust is moving with a small acceleration. The passenger will feel some increase in weight and the apparent vertical will coincide with the true vertical. Subsequently as the rocket is accelerated, its weight will decrease, but the acceleration will not yet be large because of considerable drag in a medium of great density. As the rocket begins to leave the dense at-

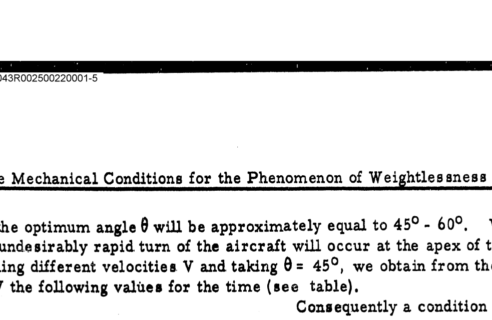


Fig. 3. Variation in apparent weight during a rocket flight: a-climb along the vertical; b-inclined motion with the motor in operation; c-motion after cessation of thrust.

mosphere, the ratio of the excess thrust (P-Q) to the weight G will increase and the apparent weight of the passenger will increase considerably as a result of a decrease in Q and G.

At some point the control system will begin to turn the rocket and will put it on the inclined flight leg (Fig. 3b); the passenger will be pressed heavily to the floor of the rocket. The position of the apparent vertical will still coincide with the axis of the rocket, but the surface of the earth will appear inclined. As soon as the motor ceases operation, the force which pressed the passenger to the floor will disappear, and, if the drag remains, the passenger will be pressed to the ceiling (Fig. 3c). With a further increase in altitude and a decrease in air density, the resistance will gradually diminish and finally will practically disappear — a condition of weightlessness will result. It will continue as long as the rocket moves in space with rather low density. But since a very small resistance force remains, objects swimming inside the cabin will begin to move towards the forward wall and will be pressed to it very lightly.

Under the action of the slight resistance, the altitude of flight will slowly decrease and the line of motion will be like a spiral inclined more and more steeply in the direction of the earth's surface. Upon entering into the dense layers of the atmosphere, an extraordinarily large and sudden increase in resistance will take place, and the rocket passengers will be pressed violently to what will be the front wall with respect to the line of motion.

If, under a condition of weightlessness, the rocket rotates in flight, stresses in its structure will appear which will keep the rocket components from flying apart. These stresses will cause a local feeling of weight and the feel of an apparent vertical. The weight will depend on the speed of rotation and the distance from the center of gravity of the rocket; while the apparent vertical will pass through the point under discussion and the rocket's center of gravity. Since man can detect rotary motion, this circumstance will prevent a feeling of weightlessness.

AUTOMATIC AEROSTATS

Engineer Lt. Col. V. L. AGAMIROV
Engineer Maj. A. N. GLUKHAREV
Engineer Capt. V. P. ANTIPOV
Engineer Capt. D. P. MOROZOV

Aerostats are lighter-than-air flying aircraft. The first flights in them in Russia go back to the thirties of the eighteenth century. At that time people went up in free aerostats that moved with the atmosphere. Later on there began the development of other types of aerostats also — captive and guided, those equipped with engines and control surfaces (dirigibles and motorized aerostats).

In recent years, automatic (pilotless) aerostats have become most widely developed.

The flight of an aerostat and its drift at a constant altitude are determined by the lift of the lighter-than-air gas contained in the envelope. If the lift of the aerostat is greater than its flying weight, then it climbs. Up to the zone of tautness, i. e., the altitude at which the gas fills the entire envelope, the lift of the aerostat is constant; in further ascent the gas escapes into the atmosphere, the lift decreases, and at the static ceiling it becomes equal to the flying weight.

Equilibrium of an aerostat at the static ceiling is attained at the moment the lift is equal to the flying weight.

Strictly speaking, an aerostat in flight is almost never in equilibrium but is continually oscillating. Equilibrium is disturbed by changes in the temperature of the gas relative to the temperature of the outside air and by loss of part of the gas when the zone of equilibrium is exceeded at takeoff; the gas permeability of the envelope also has an effect on equilibrium. All this results in that the lift of an aerostat is constantly changing.

In daytime flying under the influence of solar radiation the envelope of the aerostat is heated to a temperature higher than that of the ambient air. And since hydrogen has a good heat conductivity, this heat is transferred to all the gas contained in the envelope. The heating of the gas increases the lift of the aerostat and it rises until such time as an equilibrium of forces is again attained at a new altitude. A part of the expanding gas will escape through the appendix, by means of which the envelope is connected with the atmosphere, and the greater the superheating the greater will be the loss of gas. The increase in the equilibrium altitude of the aerostat in this is not great — about 4 m for each degree of superheating (for hydrogen). Consequently, in itself superheating in daytime flying constitutes no danger since the disturbed equilibrium is restored automatically.

With superheated gas in night flying the situation is different. The gas inside the envelope is cooled, its temperature gradually equalizes with the temperature of the ambient air, and the reduction in the volume of gas leads to a reduction in lift and to descent of the aerostat.

To restore equilibrium with a new lift value, the flying weight is reduced — part of the ballast (sand, metal shot, liquids, etc.) is thrown overboard.

Thus, the principal factor affecting the flight endurance of an aerostat is superheating and subsequent cooling of the gas in its envelope.

When envelopes were made of rubberized materials the gas was superheated to 60-70° C, which required a large expenditure of ballast, hindered the extension of flight duration, and, consequently, also limited the possibilities of using aerostats. Now envelopes are being made of transparent plastic film, due to which the flying qualities of aerostats have been increased considerably, and the possibility has arisen of using them to perform new tasks.

The plastic (polyethylene) film has a higher coefficient of translucence to waves of the visible and the infrared spectra. This reduces the superheating of the gas, permits carrying a smaller stock of ballast and more special freight, or, with the same amount of ballast, increasing flight duration.

Mass utilization of aerostats for directed flights for very considerable distances has in large measure been made possible by successes in the investigation of the jet streams in the atmosphere.

In connection with the fact that in the northern and temperate latitudes the air is cold while in the southern latitudes it is warm, under the influence of the deflecting force of the earth's rotation quite narrow zones of great temperature contrast are created in the atmosphere, which leads to the rise of strong winds and the movement of large masses of air from west to east (jet streams).

Jet stream is the name given to currents of air at altitudes of 9-12 km (near the tropopause) that are characterized by high wind velocities (150-250 km/hr on the average). Their length is several thousand kilometers, their width attains 1500-2000 km, and their height 4-6 km. The speed of the wind is at a maximum at the axis of flow (200-600 km/hr) and gets weaker on the periphery.

The flight of an aerostat relative to the ground may take place at different altitudes (up to 25-30 km) and in any direction. However, the greatest distance and stability of flight are achieved when jet streams are utilized. But the jet streams of the temperate and high latitudes (40-80° N. Lat.) are quite variable. Developing in one latitude, they dissipate relatively quickly (in two to four days) and reappear in another. Consequently, in order to make use of these streams for solving problems in present-day navigation, it is necessary to know their altitude and geographic location.

The study of jet streams and of the possibility of utilizing them for aerostat flying for considerable distances has been going on for some time. At the end of WW II some countries were launching automatic aerostats with incendiary and demolition bombs (Fig. 1). The jet streams over the Pacific Ocean were used for this. About 9000 such aerostats were released, and a substantial part of them reached their targets.

Experiments are being conducted in various countries in launching aerostats by

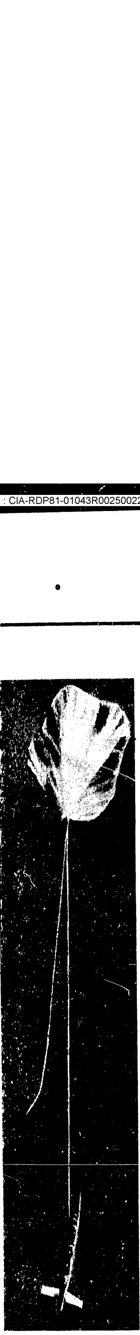


Fig. 1. Aerostat with torpedo.

the so-called "Boomerang" system. The essence of this system is that the automatic aerostat flies in the jet stream first toward the east at an altitude of 9-14 km and then, at a command transmitted by radio, it rises to 25-27 km. There, getting into the stream flowing from the east, it moves westward. On the return course, instruments suspended from the aerostat make the required measurements, photographs, etc. At a radio command all this equipment is cast off and lowered by parachutes in the area where the flight started.

These and other examples confirm the existence of steady streams of air that can be utilized not only by automatic aerostats but also by aircraft for the purpose of economizing on time and fuel.

Like any free aerostat, an automatic aerostat (Fig. 2) consists of three main elements: an envelope, a suspension, and a load. The envelope is filled with hydrogen or helium. Scientific apparatus or other equipment is suspended from it by a special suspension system. There are automatic facilities for controlling the operation of these instruments and for ensuring their landing on the ground.

A distinction is made between aerostats used once and those used several times. Among the former are those whose envelope is not preserved after use. After the prescribed task has been accomplished, it disintegrates and the load is detached automatically or on signal from the ground and is lowered by parachute.

In the multiple-use aerostats, the envelope can be automatically converted into a parachute, thus reducing the rate of descent of the load. The load detaches immediately upon touching the ground.

In both types of aerostat the envelope is made of nearly non-stretching material. The gas in it can expand only to the limit of the design volume. When the zone of tautness is exceeded, it escapes into the atmosphere; this is accompanied by a reduction in lift. If the loss of lift is not compensated for by jettisoning an equal amount of ballast, the aerostat will begin to descend.

Of vital importance is the design pattern form of the envelope. Efforts to reduce its weight compel selection of a form that has the least surface for a given volume. Such a form, as is well known, is spherical. However, with an envelope of spherical form and large volume, difficulties arise in suspending the load.

The most convenient are cylindrical envelopes, but their surface area is extremely great. Therefore, quite frequently combined forms are used that incorporate a combination of various geometric solids of revolution.

Every envelope is made up of a number of separate lobate panels that are first glued together and then sewed with thread while the seams are pasted with tapes;

welding is used in joining together polyethylene panels.

On the outside of the envelope there is located a number of components and the envelope is reinforced at the points where these components are attached. In some envelopes of large size general reinforcement is also used to increase their strength. This reinforcement consists of polyethylene strips with threads of glass fiber glued to them. The coefficient of expansion of glass threads is much less than that of polyethylene film. Therefore, most of the stress on the envelope is taken up by the strips while the envelope itself is practically free of stress.

The principal components mounted on the envelope are the inflation appendix, the maneuvering appendices, automatic gas valves (in envelopes used more than once), and the suspension system.

Inflation appendices are cylindrical sleeves through which the envelope is filled with gas. In some designs (fabric), they are also used for inspection of the inside of the envelope.

To discharge the excess of gas when the zone of tautness is reached, special maneuvering appendices are used, i. e., sleeves with mechanical valves installed in them that prevent air from getting into the envelope when the aerostat is descending.

To free multiple-use envelopes of gas when converting them into parachutes, there are gas valves that are automatically opened by special mechanisms — timing devices, automatic barometers, etc. Inside such envelopes there are concentration systems for pulling the bottom portion to the top in conversion to a parachute.

To connect the load to the envelope there are various systems of suspension each of which includes two principal parts: elements mounted on the envelope itself, and component parts that connect them with the suspended load. The purpose of the former is to transfer to the envelope the stresses from the weight of the load and to distribute these stresses uniformly over its surface. Usually these are lugs, parabolic bands, and jacket nets. Most extensively used is the system of suspension on bands, which makes for a more uniform distribution of stresses. However, for envelopes of large volume, especially non-spherical ones, use of this system presents considerable difficulty; because of this, concentration clamps have come into widespread use for the suspension of polyethylene envelopes.

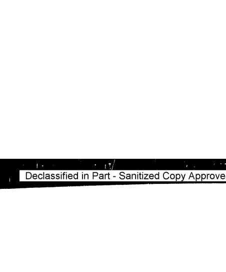


Fig. 2. Schematic diagram of an automatic aerostat.

These clamps are shaped rings into which the pleated edges of the envelope are gathered and fastened with collars.

In addition to the elements mentioned, there are in the suspension system various shrouds, bands, turning mechanisms that provide for free movement of the load, and others. Necessary accessories of every aerostat are automatic uncouplers that detach the load from the envelope either in flight or on the ground. These automatic mechanisms operate in relation to flying time, altitude, or on a command from the ground transmitted by radio. In aerostats with multiple-use envelopes in which the load is detached at the moment of landing, impact-type automatic uncouplers are

used.

The loads suspended from the aerostat are carried either in standard light gondolas or on special beams.

An important place in the construction of modern aerostats is occupied by automatic equipment designed to regulate the flying regime, to control the work of the apparatus and its landing, and to determine the location of the aerostat from the ground. These are electric power sources, shortwave and ultrashortwave radio receivers and transmitters, barometric stabilizers of flying altitude, etc.

The large number of automatic devices of varying purpose requires, as a rule, that a special command and programming mechanism be included in the layout to control the work of all the above elements in a certain sequence by a predetermined time schedule. This mechanism sets the time for the beginning and the sequence of operations of the special apparatus, modulates the radio transmitter with the call signals assigned to that particular aerostat, sets the time for the radio apparatus to begin operation, gives commands to cast off ballast, etc.

Inasmuch as the commands sent to the automatic apparatus are coded, the command and programming mechanism is connected to a special decoder. Receiving signals transmitted from the ground by radio, the decoder determines their correspondence to a given code and then transmits them for execution. If the commands do not correspond to the code, the decoder forestalls the operation of the apparatus.

The aerostat is piloted automatically only in respect to altitude by reducing or increasing the lift by means of the automatic gas valves, the maneuvering appendices, or by jettisoning ballast. To jettison ballast, the automatic aerostats are equipped with special ballast jettisoning devices consisting of a ballast carrier and a control mechanism.

The ballast is cast off in portions, for which purpose there are measuring facilities. Electromagnetic valves have recently come into widespread use. The principle of their operation consists in magnetizing and demagnetizing an iron powder (the ballast) by passing a current through the winding of a magnet. When magnetized, the powder coagulates and forms a plug; when it is demagnetized it returns to a free-flowing state. The moment for jettisoning ballast is determined by time or flight altitude or is given by radio command from the ground.

Comparative simplicity of construction, a high flying altitude, long duration in the air, and movement for long distances with air masses in directions known in advance — these are the principal positive qualities of modern automatic aerostats. These qualities, and the possibility of controlling flight altitude by means of modern electronic and automatic apparatus make it possible to use aerostats in scientific research work.

ENGINEER OF A LINE UNIT

Engineer Col.
A. YE. TATARCHENKO

Engineer of a line unit... The commander's deputy for the Air Engineering Service... Let us think about the meaning of these words... Today not a single important matter in the regiment can do without the engineer. He is always busy and is usually on the go.

The figure of a messenger suddenly appears beside him.

"Comrade engineer, the commander is asking for you."

And again, the unit duty officer gets an order to find the engineer: the inspector has arrived.

And there, visible from afar, a technician dashes out of the TECh [technical maintenance unit] hangar toward him. Evidently something serious had been found in disassembling a plane and the engineer's help was needed.

Multifarious and complex are the duties of an engineer, and he not only knows them but also fulfills them selflessly and creatively. Yet it seems that it is only a very short time since the young officer first came to the unit. Even the most elementary — from the point of view of an experienced specialist — questions not infrequently grew into a major problem in those days...

I, for example, remember well my first period of service in the regiment. In May 1943 our group of Academy students arrived at one of the front-line airfields.

It was spring. On the cold, clear mornings a greenish-white haze spread through the sparse grove of birches at the edge of the airfield. On the front there was a lull preceding the battle of Kursk. The aircraft to which I had been assigned as understudy to the technician flew only one combat mission during my period of service. I had only to help service the plane, to camouflage it, and occasionally to participate in replacing an engine on some other machine. Even with such a small amount of work I, as a green engineer, frequently got into difficult situations.

For example, I knew perfectly well that the aircraft should be supplied with compressed air. I also knew in detail the theory of compression. Adiabatic and polytropic curves were no secret to me. But I had no idea how this was done in actual practice.

In order to fill the gaps in my knowledge, I spent evenings at the compressor and battery-charging stations. I studied the automatic starter and learned how to start a plane with it. I visited the GSM [fuel and lubricants] depot and studied the procedure of analysis, storage, and distribution of fuels and lubricants. In other words, I studied with enthusiasm the so-called supply kitchen, which is so very important in our operating specialty and to which so little attention had been devoted in the period of training.

Yes, there are many contradictions in the status of a young engineer just arrived at a unit.

On the one hand, there is a great responsibility for every sortie , while on the other there is the actual helplessness of the first days and months; he is the superior of many subordinates, and yet the subordinates are more experienced than he is. And at every step there are the riddles posed by life...

...The commander returns from a mission.

"Engineer, something or other tips my plane to the left. Even my arm gets tired. What can be done?"

Your brain works feverishly. Cx's and cy's flash through your mind, but the right answer you cannot find.

"Perhaps the angles of incidence of the wings are different, Comrade Commander..."

And you keep thinking, "tips to the left...tips to the left...arm gets tired... What does the arm have to do with it?" And how should you remember that on this fighter the wings are non-detachable?

But saying not a word, the commander takes a pair of pliers, goes up to the left wing, and bends down the trailing edge.

"Is that enough, Comrade Engineer? Or should I bend it more?"

How is a young engineer to know whether it is enough or not.

"Have to test it aloft, Comrade Commander."

"That is right!"

The commander got into the machine and tried it out. Everything was all right. There you have your angles of incidence...

Another time the commander complained of engine vibration. And again academic abstractness revealed itself. "Crankshaft out of balance" was the diagnosis of the young engineer. The commander even choked on hearing this revelation, but first he ordered that the sparkplugs be changed. And it must be admitted that the vibration disappeared as though by magic.

How much effort the commanders, senior engineers, and his comrades put into initiating the young specialist into the unit! The old fliers tell tales of how at one time they would try to make a fool of any new man, and especially an inexperienced officer by a whole system of prearranged "skits". Those times are long past. An atmosphere of comradeship and a spirit of mutual assistance — this is the standard of behavior of aircraft specialists in our times. It must be remembered, however, that the attitude toward a new man depends to a great extent on himself.

The young engineer sent to a unit should tell himself honestly: Yes, I have completed theoretical training, but I have little practical experience. The people who will be working under my direction have immeasurably more experience than I. On what then should our relationships be based? Obviously, on a mutual exchange of knowledge. I will teach them, but at the same time I will learn from them. Does that mean that at first I should shut my eyes to the shortcomings of the work of my subordinates? Not by any means. It is wrong to believe that you do not have the

"An indefatigable efficiency man" — that is what they call senior technician Lt. A. I. Shishkin in unit X. In 1957 he made four major efficiency suggestions that made it possible to save quite a bit of government means.

In the photo: Efficiency-Officer A. I. Shishkin at work on a new instrument.

Photo by A. I. Dotsenko

moral right to make proper demands until you acquire experience yourself.

Having explained this to himself, the young engineer can go boldly to the line unit. He will be met by a cohesive team, friends and comrades-in-arms. Not only will they not try to undermine his authority, but, on the contrary, with all the strength that the team is capable of, they will help the young specialist to become a full-fledged aircraft engineer.

Indubitably it is impossible to foresee in advance all the difficulties that will be encountered in the early stages. Mistakes, too, are unavoidable. Some engineers, for example, when beginning their work, concern themselves only with servicing aircraft equipment for flight, forgetting to analyze how this equipment is used.

Yet is is quite clear that the capabilities embodied in an aircraft are realized only in operation. Improper use of equipment may lead to abuse of its capabilities and, consequently, to air accidents or their causes or — to a reduction in the combat potential of the aircraft.

The notion that the capabilities of equipment are manifested or are reduced to nought precisely in the process of application is confirmed by actual practice.

...A fighter is serviced for a scheduled flight with drop tanks. Its flight characteristics (except for range and endurance) are lowered because of this. However, it is decided to intercept a target flying nearby without taking off the tanks. Why? Just because it takes time to drain the fuel, while no device for jettisoning full tanks had been made in time. Furthermore, the commander decided that the tanks might be useful in any case.

Here we encounter the fact of incomplete utilization of all the capabilities of the aircraft, since interception of a close-flying target with drop tanks is considerably more complicated...

...A fighter is returning to the airfield. Passing over the flying field, the pilot suddenly pulls up steeply, creating considerable acceleration forces. One of the tanks breaks loose, and the other is automatically jettisoned. Fortunately, the pilot countered the incipient bank in time, and the tanks fell in an uninhabited area. After the landing it was found that the outer skin of the wing was damaged. All this happened because the pilot abused the capabilities of the aircraft. He did not consider that with drop tanks great acceleration forces cannot be permitted. And this could have led to a serious accident.

...To "facilitate" the interception of a high-speed target, it was decided to send up a supersonic fighter on patrol. However, the target was not attacked at the prescribed limit. It happened that at the moment the target was spotted the fighter was flying at such an angle to its course that the turn into the rear hemisphere and the subsequent pursuit on the part of the interceptor took too much time and the "enemy" managed to cross the prescribed limit.

In this case it would have been better to intercept the target from an alert position on the ground, because the climb to the required altitude to get to the estimated point of encounter at a prescribed angle-off would have taken less time than the turn and pursuit from the patrol position.

...In an effort to expend a minimum of time for gaining speed when the target appeared, the commander of a flight patrolling an area established a high flying speed, which, naturally, resulted in excessive consumption of fuel. On the turns the outer wingmen,in order not to lag behind, were compelled to change to maximum rpm and some even turned on their afterburners. As a result, the flying time of the element was reduced substantially, and one of the wingmen returned to the airfield with nearly empty tanks. This example again shows insufficient consideration of the capabilities of aircraft equipment. By turning on their afterburners, the pilots could have accelerated their planes quickly, while the distance at which the "enemy" was spotted by ground radar would have given the element time to gain the initial position for attack.

Engineers teach pilots the utilization of combat equipment primarily at exercises that are conducted as part of the program of ground training courses. They acquaint the pilots with new equipment and new instructions, give tests and grade them. On the whole, however, participation of engineers in the teaching and training of flying personnel is still inadequate. This is not because there are too few exercises but because they are frequently devoted either to mere theory or to practice alone.

Engineer Capt. V. A. Konstantinov, during a session on aerodynamics, for example, explained to the pilots in detail how to construct curves of rated and available thrust and how to find characteristic flying speeds by these curves. However, both the figures presented and the curves themselves pertained to some abstract aircraft and not to the one the pilots flew yesterday and would fly tomorrow. Naturally, interest in the lesson was not very high.

Just the opposite in nature was a lesson conducted by officer V. D. Novikov. In connection with the fact that there had been several cases where the flaps of the afterburner did not open, he read to the pilots the instructions on safety measures in switching on afterburning. The engineer recounted in detail what to do and when, what to push, and where to look, but he did not support his account with theory, he did not explain the essence of the method of augmentation by afterburning. As a result, some of the pilots gained the wrong impression that augmentation is the result of an increase of air through the engine when the flaps are opened.

Yet it is known that this is a method of temperature augmentation in front of the jet nozzle. Supplementary expansion of the gases leads to an increase in the speed of their discharge. The nozzle flaps must be opened to maintain the consumption of air. If the flaps are closed, it is reduced and the engine becomes overheated.

The theory of such augmentation should have been explained in the lesson, and then the pilots would have understood better why, in switching on the afterburner, it is necessary first of all to watch the temperature of the exhaust gases; and it would also have clarified the other recommendations.

In instructions for the Air Engineering Service, too, theory is not always tied in with practice.

With his advice and, where necessary, with his calculations, the engineer is obliged to help the commander and the pilots make the most expedient decision in each specific case.

And, of course, the majority of the lessons conducted in line units should be of an applied nature, i. e., should be devoted to a study of one's own plane, the methods of utilizing it in combat, and its technical operation.

In the press they frequently write about the organization of servicing aviation equipment, how engineers and technicians replace engines quickly, how they take care of equipment at parking and work areas, how they improve the regular inspection work. Also encountered are negative examples of attempts to take off with catwalks left on the wings, of tools left in the aircraft, of chocks not removed in time. But this hardly exhausts the concept of air engineering competence, the principal representative of which in the unit is the engineer. He watches keenly the rhythm of life in the regiment, studies the methods of combat utilization of aviation equipment, systematically analyzes and generalizes the experience in applying it. The engineer is vitally interested in the general success of the undertaking to which he has dedicated his life.

By their participation in many new undertakings, deputy commanders for the Air Engineering Service, officers V. M. Raskin, V. G. Derkach, V. P. Zamorov, and many others have done themselves credit.

Once during training two identical groups of aircraft took off on a mission from the same airfield. The second group required 3 minutes and 20 seconds more from starting to takeoff than did the first. The interval between paired takeoffs was on the average 10 seconds greater and between landings of the aircraft 50 seconds greater. As a result, the second group took 5 minutes and 20 seconds more for takeoff and landing than did the first. The result was that it lost 8 minutes and 40 seconds at the airfield, while the first group spent this time over the "field of battle".

On the basis of the experience of this and other flights, officer Raskin worked up a whole series of recommendations for the spacing, starting, taxiing, takeoff, flight, and landing of aircraft, which increased the effectiveness of the operating equipment.

Once, two groups were ordered to attack target No. 1 using live ammunition and then, after a short period of time, target No. 2.

Engineering and navigational computations showed that too little time had been allotted for servicing all these planes for a repeat combat sortie. Not relying on the computations alone, engineer Zamorov conducted a servicing rehearsal which confirmed the fact that there really was not enough time. However, the officer decid-

ed to find ways for carrying out the order exactly within the prescribed time. He suggested that a spare group of aircraft be serviced. Then the pilots of the first group, after returning from the attack on target No. 1, could change over to the ready-serviced aircraft. A double crew of armorers could service the machines they left by the time the second group landed. In this way each pilot would change over to the plane that he had already flown over the range. By virtue of such organization, all the crews hit the targets precisely on time and carried out the order.

In practice, an engineer often is in a position where it is necessary to make quick and quite complex calculations associated with the use of aviation equipment, and these calculations have to be made in circumstances that do not permit use of textbooks and manuals.

I dare say, it is difficult to find an aspect of life in a unit that does not interest the commander's deputy for the Air Engineering Service. For example, does not the planning of combat training concern him, inasmuch as he is responsible for the equipment and the technical operation in carrying out the plan?

In one of the units the engineer, analyzing the results of the work, could see that from year to year the flying plan was considerably overfulfilled; that more engines were replaced and more regulation inspection work was performed than required; that the balance of spare equipment was below the permissible limits; that the working day was frequently in excess of the norm — although all this did not follow from the tasks that were assigned at the beginning of the year.

What was the matter here? Perhaps many additional tasks were assigned during the year? Yes, this did happen, but they were usually assigned in place of others and had little effect on flying time. It was found that the shortcomings of planning in the new year were an echo of the method used to evaluate the results of the unit's work. The results of the work were evaluated by three basic criteria: absence of accidents, fulfillment of the flying plan, and fulfillment of the plan for elements of combat application. Among the units without accidents the best was considered the one that had fulfilled its flying plan. The elements of combat application were considered secondary. This resulted, in the first place, in that at the beginning of the year it was convenient to set the plan of combat application low, since this would ensure certain fulfillment of it. In the second place, they did not save on fuel and spare equipment but operated under the slogan "Let's fly", not thinking through carefully, pencil and slide rule in hand, the organization of the flying days.

By fall, they began to discuss in the unit how the limit of fuel had been exhausted, and telegrams poured out: Give us fuel! And they supplied it and even praised them: "Well done! They have used up all their fuel and December is still a long way off."

What were the results usually by the end of the year? The plans for flying time and for a number of elements of combat application were overfulfilled, but for certain important elements of combat application they were generally unfulfilled. Evidently, the engineer decided, such planning has basic shortcomings if the consumption for fulfillment of each element of combat application is higher than in the other units. Obviously the planning was poor if fuel, engines, and spare parts were systematically obtained at the expense of other units. The engineers and technicians, working day after day over the prescribed time, without the required number of grounded days, and even with a shortage of spare parts, could not provide such servicing of aviation equipment as would eliminate failures and, therefore, the causes of flying accidents. Finally, it must be taken into consideration that the increase in the number of flying days was compensated by a reduction in the number of days for ground servicing, and this resulted in a deterioration in its quality.

And the engineer was absolutely right when he suggested that the basis of evaluation of the work of a unit be first of all the fulfillment of the plan according to the elements of combat application. And if this plan is fulfilled without a significant excess of flying time over the allotment, then it can be considered that the planning is at the proper level. In such a unit it will be possible to conduct flying operations by a strict schedule without "snatching" weather, without prolonged waiting for openings in an overcast sky.

It must be said that the idea of regular flying operations on days and nights strictly fixed by a schedule is definitely superior. Only with such organization is it possible to overfulfill the plan and reduce the causes for flying accidents. We have every reason to believe that flying operations without proper alternation of ground and preliminary servicing, flying days, and grounded days will be just as impossible as operation without fuel.

Of course, the schedule is not an end in itself. The unit must be ready to carry out a combat mission on any day, irrespective of whether that day is listed in the schedule as flying or non-flying.

An experienced deputy commander for the Air Engineering Service does not confine himself to a limited range of "purely engineering" problems; he constantly contributes his efforts and knowledge to those "bottlenecks" in the daily life of a line unit that are inevitable in any business.

A good engineer organizes the servicing of aviation equipment in such a way as to trouble the commander as little as possible with problems that he can and should solve himself, since even without this air commanders are occupied every day, every hour with the resolution of complex and responsible problems in all kinds of fields.

An engineer, like any other worker, cannot successfully solve even a single problem unless he relies on the Party organization. In his work with young officers and with junior specialists the engineer leader must be very considerate and tactful, must study the men comprehensively, must develop high moral combat qualities in them, must give of his knowledge and experience, must instill a feeling of confidence in successful mastering of complex aviation equipment.

The aviation specialists of unit X are constantly working on improving the methods of technical servicing of aviation equipment. To this end, many instruments, stands, and devices have been developed here. Senior Technician Lt. I. T. Machnev — chief of the regulation inspection work group — has also made a contribution. He designed and assembled a general-purpose instrument for testing electrical systems and aircraft armament.

In the photo: Senior Technician Lt. I. T. Machnev preparing a testing and measuring stand.

Photo: A. I. Dotsenko

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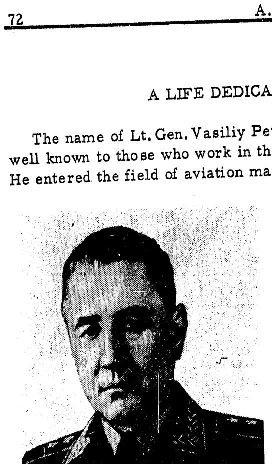
A LIFE DEDICATED TO THE MOTHERLAND

The name of Lt. Gen. Vasiliy Petrovich Kuznetsov, a talented test engineer, is well known to those who work in the field of technical equipment of the Air Force. He entered the field of aviation many years ago. In 1920 the regimental command sent the capable young engine mechanic to the Leningrad Military Engineering School.



Lt. Gen. of ITS [Engineering-Technical Service] V. P. Kuznetsov.

After finishing school, V. P. Kuznetsov began working as a mechanic in the Moscow Training Squadron and later at the central airfield. Here in 1925, a senior mechanic, he serviced domestically-produced aircraft for the first group flight on the Moscow-Mongolia-Peking route, a distance of about 7000 km. The flight was made under very difficult conditions, but was completed without a single breakdown; V. P. Kuznetsov, the flight mechanic, took care of this, indefatigably attending to the equipment both on the ground and in the air. For performing his duties on this flight in exemplary fashion, he was awarded the Order of the Red Banner and an honorary Silver Weapon.

In the 30's, engineer Kuznetsov, already graduated from the Zhukovskiy Academy and assigned to the Scientific Research Institute of the Air Force, was confronted with problems associated with aircraft engines, equipment, fuels, and lubricants. Studying engines, the inquisitive experimenter, together with other engineers, found a solution to what was at that time one of the most vitally important problems of the VVS [Air Force], a problem associated with increasing the flying range of aircraft.

Vasiliy Petrovich has done much to make possible the use of high-altitude engines in aviation. To him belongs the idea that such engines must be tested not in an altitude chamber, but under natural conditions by means of special facilities mounted on a truck. To this end he organized an expedition to the Pamir, and there under difficult climatic conditions, together with other engineers, he tested new and powerful air-cooled and liquid-cooled aircraft engines with superchargers.

The main testing point was at an altitude of 5000 m, i.e., an altitude where flying can be done only with oxygen masks.

Squalls and storms threatened to throw the men and the mobile engine-testing station into the chasm. The testers suffered from headaches — this was "altitude sickness" — because they had to breathe rarefied air while doing heavy physical

work.

The tests in the mountains went on for five days. The work that was done facilitated even more extensive incorporation of high-altitude engines.

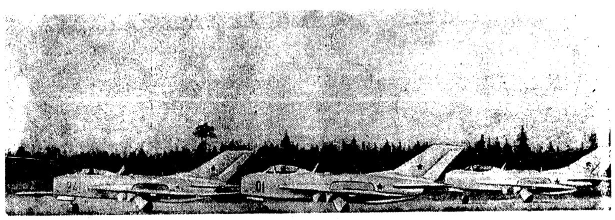
A year later V. P. Kuznetsov wrote a book, "High-Altitude Testing of Aircraft Engines M-25, AM-34N, M-85, and M-100" (Voyenizdat [Military Publishing House], 1939), that still retains its importance at present.

From 1938 to 1940, Vasiliy Petrovich directed an engine outfit. Sparing no effort, he gave of his wealth of experience to young aircraft engine specialists.

During the Great Patriotic War, V. P. Kuznetsov occupied the post of Deputy Peoples Commissar for the Aircraft Industry. He rendered much assistance in many ways to bureaus of design and plants which were developing new types of aircraft engines, not infrequently participating directly in the solution of this or that design problem.

V. P. Kuznetsov has worked just as productively in the postwar years. As a member of a government commission, he has done much to improve the quality of aircraft industry production.

Lt. Col. of the Technical Service A. Ye. Musiyenko



THE WORKING DAY OF AN ENGINEER

Senior Engineer Lt. V. A. GRECHIN

. . . Night. Dawn is still far away. The frosty silence over the airfield is constantly broken by the powerful roar of jet planes which are taking off on missions, returning for fuel, oxygen, air, and then — off again into the air.

At the flight line there is a bustle of people, fuel trucks, starter assemblies. The technical personnel is readying the planes for repeat sorties. Work in the dark is strenuous. But everything is done without bustle. If the equipment is serviced properly the day before, everything goes smoothly.

Difficulties sometimes arise from other causes. Sometimes for a number of reasons several pilots fly the same aircraft. From the beginning to the end of flights the plane is in the air. The inspection and checking has to be done in those few minutes when the plane returns for refueling. Even with tight scheduling, the specialists manage to do all that is essential.

It cannot be said that we accomplished all this with ease. Our success was due to good ground training, timely and efficient execution of regulation inspections and additional work. Every piece of equipment, and that of aircraft in particular, requires careful attention.

Servicing planes for night flying is no simple matter.

With the development of equipment, the methods of operation and maintenance of it on the ground and in the air change accordingly. In contradistinction to previous years, the present-day basic method for assessing the condition of equipment is that of instrument testing by using testing and measuring devices.

This apparatus finds particularly wide application during post-flight check, when defects are eliminated and regulation inspection work is carried out. Experience has shown that combat readiness of a plane is entirely dependent on preliminary servicing.

It is often said that the workday of the engineering-technical personnel begins

early in the morning and ends late at night, and that the technician "lives" on the parking area. Everyone usually answers the question: "Why is that so?" in the same way — "Plenty of work. Flights, servicing for flights, checks, regulation inspection work. And then there are so many unforeseen details that take up a lot of time." There is indeed so much to be done that one can hardly manage to do everything in the course of the day.

When I came to the unit to fill the post of a special equipment engineer, I got acquainted with the nature of the work and my round of duties and the doubt crept into my mind whether I would be able to cope with the work. But life makes its demands. Pilots must fly under all weather conditions, both day and night, and fly aircraft that is operational and carefully serviced. It became necessary to organize the workday on lines that would ensure efficient use of every man's every minute.

Taking a single day as an example, I shall try to illustrate how aircraft equipment is serviced in our unit, what problems an engineer has to solve, what difficulties are encountered and how they are overcome.

With the change-over to a seven-hour workday it seemed impossible to do all the tasks in so short a time. And indeed many in the beginning could not cope with the situation and were often lagging behind. But due to proper organization and concerted effort, the proper tempo was found. Now every specialist knows precisely the content and the sequence of inspections and methods of making them. This ensures fast detection of the smallest defects in equipment and helps to determine their causes.

The day we are going to speak about began with political studies in a group of sergeants. An engineer was holding classroom instruction. In two hours we assembled at the parking apron. The problem for the day had been assigned at formation, and now group chiefs quickly assigned the mechanics to their work stations.

Let us now see what an engineer does.

In the first place he organizes and checks all the work, inspects several machines in every outfit, checks equipment, and makes entries in the forms.

While the specialists are servicing the aircraft equipment, the engineer manages to visit the TECh [Technical Maintenance Unit] group where he gives instruction on additional work and sees that regulation inspections are carried out.

In the middle of the day in question the engineer met a representative of one of the supplying plants. Such meetings occur quite frequently. Many questions have to be settled together with the representative; claims and technical statements must be drawn up; instruments and assemblies out of repair must be returned and new ones received in exchange. But this is not all. We try to take advantage of every visit of a representative to find out the characteristic equipment failures in other units and groups, the operational peculiarities of individual assemblies, instruments, installations, and systems. The plant representative can tell many things from his own experience and also of the experience of work organization on other airfields. Such discussions help us to avoid a whole series of failures in aircraft equipment. We also often have our own suggestions right in the unit for the elimination of minor defects. Sometimes, for instance, the indicator of the TRZ-52 fuel flow meter gets out of repair. We took one of the devices apart and found that the cause of the failure was due to the dropping out of the scale ball from its tube. Such a defect we eliminate ourselves.

The present meeting with the plant representative proved of great value for the engineer.

At the end of the workday, according to plan, the engineer met in conference with the efficiency men. That day they were assembling and setting up a TL-1 trainer for pilot training.

We have merely touched upon the highlights in the engineer's work that day. But how many other things there are to be done ! He has to visit the servicing station, hold instruction classes for technicians.

How then to schedule the time?

The engineer's immediate aids are the group chiefs. The engineer, however, does not watch over the leader officers, but gives them the opportunity to act independently and on their own initiative. On being assigned a task, they themselves organize instrument testing of assemblies, station their subordinates so as to get most efficient work results, distribute testing apparatus, provide the mechanics with the necessary materials in advance. In order not to distract many people from work making out requisitions for spare parts, instruments, and assemblies, the drawing up of accounting papers and the receiving of different items from the warehouse is done by one of the group chiefs. This permits not only a rigid order of supply and more effective operation, but also eliminates confusion in drawing up the various forms.

Specialists service the equipment in a definite sequence, endeavoring not to omit a single detail. Special attention is given to those instruments and assemblies which, in the opinion of the flight crew, did not function properly.

A good technical training of mechanics is a guarantee of success in work. When we first received new jet fighters, the main problem was to master them as quickly as possible. To cope with the problem, we began to train narrowly specialized mechanics. This, however, soon proved inadequate. Classes were held to study the whole complex of the special aircraft equipment. Not only were the diagrams and design of the installations studied, but also the methods of operation, servicing, and checking. Junior Sgt V. S. Kozlov, Pfc A. I. Plandin, M/Sgt A. T. Gorelyshev, and many others have already acquired a sound knowledge of the specialties of the electrician and instrument man. Pvt. G. S. Zenchev has mastered well the procedures at the oxygen servicing station. This makes it possible, when necessary, to replace one of the mechanics and to save time in servicing aircraft for the takeoff.

Due to good technical training of specialists, not only was the time for carrying out the different operations cut down, but also the number of aircraft equipment failures.

Even the best designs, devices, assemblies, instruments, checking and measuring apparatus are far from being ideal. "Kinks" and "rough spots" will always be found in them. To find and eliminate them is exactly the ability possessed by specialists who know the equipment well.

Careful study of aircraft equipment and analysis of every defect reveal a number of important peculiarities of equipment operation and maintenance.

Striving for efficient control over aircraft equipment, men show much creative initiative, work out new methods of testing combat planes. Officer N. V. Belov, for instance, suggested checking the efficiency of the fuel flowmeter on the aircraft itself. This is done as follows: the toggle switch is turned on under the "radio" name plate, as well as the "radio fuel flow meter" toggle switch, and periodically the "control instruments" toggle switch is turned on and off. If meanwhile the scale of the fuel flowmeter is displaced the thyratron interrupter and fuel flowmeter indicator are working.

It is common knowledge what importance is assigned to the system of static and total pressure of the PVD [pitot tube] intake at the time of servicing an aircraft. Particularly careful testing is necessary in winter when clogging of pipes or formation of ice plugs owing to the freezing of condensation are frequent. Besides that, disruption of the pressure system is possible at pipeline joints and at instrument outlets. To save time on this operation and for convenience we have made at our unit a special nozzle for the PVD tube which is used when checking.

The end of winter and the beginning of spring, particularly in a damp climate, is the period of most intensive work for the technical personnel. But even then the specialists of our unit service the equipment for flights quickly and thoroughly, and manage to do all the work on time.

Usually in the second half of the day the nature of the coming flights becomes known and also which aircraft will participate. If they are to be flights under adverse weather conditions or at night, the specialists check carefully the signaling, lighting, and high-altitude equipment, the soundness of connections, and the wire conditions of all electrical equipment assemblies: sources and consumers of electric energy, strands, wires, terminal switches, automatic circuits protection, and fuses. In a word, the function of the whole equipment complex is checked. Sometimes electrical generators with voltage regulators, engine tachometers, manometers, and thermocouples are checked with engines operating. The condition of equipment is determined not only by "sight" but also with the help of testing devices, either portable or on the aircraft.

During ground servicing days we check all aircraft equipment, regardless of whether day or night flights are scheduled.

The only difference is in the fact that special metal blinds are set up for night flights, made at the suggestion of officer Yu. A. Anan'yev. The blinds shut off the blinding signal lights indicating the position of the landing flaps and speed brakes. The blind is mounted under the screw of the cover plate of the signal light panel.

Work on the parking areas proceeds rapidly and is well coordinated. As work is completed on individual aircraft, the personnel is freed. It never happens, however, that in our unit people have nothing to do at the parking area. Those that are free are assigned to other work; some help their comrades, others are sent to TECh. Such mutal aid allows a more rapid completion of all operations on aircraft which are in for regulation inspection work and accelerates putting them again in operation.

Now the last engine and the equipment of the last plane has been checked. The day's assignment has been completed. Fighter planes are again ready for flight.

Before the end of the workday the engineer, as a rule, conducts a critique. Serious defects that have been discovered are studied with all the technical personnel. The engineer shows the specialists how to look for malfunctions on the basis of external signs and how to eliminate them quickly. Once, for example, the automatic air temperature control failed in the cockpit. The instrument was dismounted and taken apart. It turned out that the screen filter, clogged with dust and dirt, sagged and exacted pressure on the bimetallic spiral causing a short circuit. The critique of this case helped us to prevent similar failures on other aircraft.

Thus the day passes in our unit. It must not, however, be forgotten, that any experience must be utilized only with account being taken of specific conditions.

Now and then it happens that some engineers do not plan their workday, considering this to be of no consequence. This results in following the path of least resistance, in distracted attention, in leaving a number of questions unresolved!

We too have had such difficulties. But life showed the necessity of revising the routine practice. A plan, and a specific plan, is necessary for every day. In our work there are no insignificant details. Everything must be foreseen, considered, and executed on time and with observance of a definite tempo.

A "know-hower" is what they call V. S. Khobotov, first sergeant of the reenlistment service of unit X. V. S. Khobotov is an excellent aircraft specialist and efficiency man. He has built a device which permits testing of the hydraulic system without starting the motor on the parking apron. In the photo: V. S. Khobotov, first sergeant of the reenlistment service, at work. Photo: A. I. Dotsenko.

YEARS AND PEOPLE

(Memories of the War Years)

Lt. Gen. of the Air Force (ret.)
S. N. ROMAZANOV

5. In the Sky of the Ukraine

One evening in the first days of February 1944 Gen. Krasovskiy's aide came to see me, and brought me a small file, resembling a desk writing pad. This was the correspondence between Maj. Sichelschmidt, commander of the 210th German Assault Gun Battalion and Hoffman Schoenberg, head of the Assault Artillery School, located in the rear area of Germany. Maj. Sichelschmidt and the head of the school were evidently friends and wrote to each other very frankly. The letters of the Hitlerite officer showed quite clearly the situation which had arisen in the rear of the Fascist army by 1944. It was obvious that Nazi Germany was marshaling her last efforts and that many officers began to realize the inevitability of the approaching catastrophe.

In the course of offensive operations which had developed by the end of 1943 and the first half of 1944 the Soviet Army defeated the army group "North" and reached Narva and Polotsk. At this very time the southern enemy concentration was utterly routed. After liberating Pravoberezhnaya [right bank] Ukraine, our troops reached the Dnestr and the approaches to L'vov and Kishinev.

It is clear that this advance was not easy. The enemy did not want to give up his positions and open the ways of approach to his borders. On his southern flank the enemy had the largest troop concentration. Army groups "South" and "A" occupied a defensive position on the sector stretching from the mouth of the Dnepr to the river Pripyat'. There were five armies in both groups. If one takes into consideration that to the south of the river Pripyat' 19 tank divisions were concentrated, one can have an idea of the feverish efforts with which the Germans were defending their positions in the Ukraine.

At the beginning of February 1944 troops of the First Ukrainian Front under the command of N. F. Vatutin, overcoming the stubborn resistance of the enemy, broke through a strongly fortified German defense line in the Belaya Tserkov' area and rushed to meet the troops of the Second Ukrainian Front, which, under the command of Gen. I. S. Konev, had turned to the offensive from the area north of Kirovograd. On 3 February units of both fronts joined in the Zvenigorodka-Shpola area, closing the circle around a large enemy concentration. In this way was formed the Korsun'-Shevchenko "kettle", into which fell ten infantry divisions and one motorized brigade.

The advantages of Soviet troops were so obvious that there was no doubt the German

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divisions which had gotten into the "kettle" would soon be definitely destroyed. Yet the Soviet command, led by humane principles, proposed that the German command discontinue resistance and surrender. The Hitlerite generals declined this demand. We were forced to resume combat operations.

Units of our army carried on day and night aerial combats, supporting ground troops at the front. In a short time Soviet pilots made 3539 combat sorties, downing 75 enemy planes in 56 aerial combats alone, and destroying on enemy airfields 123 planes, mostly three-engined Ju-52's. More than 200 tanks, 800 vehicles, and over 400 various depots were destroyed and damaged by strikes from the air.

One of the main problems which our units were facing during that period was the destruction of junction railroad stations and bridges (for the disruption of transportation). The air raid on Shepetovka station by a ground attack group headed by Lt. I. M. Dolgov can prove how successfully the pilots carried out this important mission.

The large railroad center of Shepetovka, a junction of several railroad lines, played an important part in supplying Hitlerite troops operating against our front. While making a reconnaissance flight, Lt. Dolgov established that there were 14 large trains (covered cars, fuel tank cars, trains with tanks and guns).

On returning to his airfield Dolgov reported everything to the commander.

"It would be good to send a division of bombers against such a target," said unit commander Maj. Yefremov.

But it was not within his authority to scramble a division; besides there was not enough time for it. And the commander decided to send one "Il" group of seven planes with Lt. Dolgov at the head against Shepetovka.

Now the group of seven ground-attack bombers headed for Shepetovka; Dolgov was the lead pilot. To his right in the rear flew Maj. Sharonov, regimental political worker, a highly competent pilot.

It was snowing. Thick snow masses were whirling in the air, blinding the pilots, swallowing up the planes ahead in their milky shroud. In order not to lose sight of each other the pilots kept in closer formation, straining their eyes to the limit. Visibility being very poor, they had to descend to hedge-hopping flight. There were still 15 km to Shepetovka when four planes, flying a bearing formation under the command of Lt. Dolgov, headed for it and got ready for the ground-attack operation. At this time three planes headed by Maj. Sharonov swooped down on AA batteries in order to suppress their fire and enable their comrades to carry out the mission successfully.

They approached the station at an altitude of 400 m, started to glide, and struck with their cannon and machine guns at the train concentration. Bombs were dropped from an altitude of 50-70 m. Explosions were heard one after another, and a minute later, when the planes had turned and were flying away from the station under strong AA fire, an explosion of such force was heard, that for some time the entire station was engulfed in a cloud of fire and smoke. The guerilla detachment commander related to us afterwards that during the assault of ground-attack planes three railroad cars loaded with TNT blew up on the tracks. This blast transformed the junction station into a scrap-iron graveyard. As a result the station could not be used for a long time.

All the pilots and aerial gunners who had taken part in the assault on Shepetovka were rewarded and promoted in rank. Group commander Lt. Dolgov was promoted

to the rank of captain and was awarded the Regimental Commanders' Order of Suvorov, Third Class.

The rolling barrage of Soviet fronts was moving on westward. By the beginning of July 1944 units of the First Ukrainian Front reached the line Kovel'-Chertkov-Kolomyya; preparations for the liberation of the city of L'vov were beginning.

Under the leadership of the Communist Party the Soviet people knew not only how to restore the losses suffered by the Soviet Army during the war but also to insure its further growth in number and quality. By the summer of 1944 our army was considerably stronger than the German Fascist army in quantity and quality of troops, in abundance of equipment, in experienced command, and in the skill of soldiers and officers.

New Air Force groups arrived in order to strengthen the Second Air Army: one bomber, one fighter, and two ground-attack air corps. More than 3000 planes were concentrated on the L'vov and Sokal' line of advance. These machines were not like those with which we had begun the war. Fighter planes with a distinctly increased flight range had begun to arrive in sufficient quantity. The new Yak-3 aircraft was the lightest fighter in the world. It had unusually high horizontal and vertical speeds. In its combat qualities the Yak-3 surpassed the German "Messerschmitts".

Whole units, activated in the rear area and armed with La-7 fighters joined our ranks. Frontline pilots and recently graduated ones from schools relearned to fly a new plane, mastered air combat tactics, and arrived at the front perfectly trained. They immediately appreciated the qualities of these machines. The Pe-2 bombers and the Il-2 ground attack planes were also improved and met all the requirements of a combat situation.

By that time the skill of the pilots increased noticeably. Heroes of the Soviet Union, famous pilots and navigators served in almost every unit. Entire units consisted of experienced air soldiers who had gone through the great school of war, each of whom had several orders and medals for combat exploits.

Nikolay Shutt, a fighter element flight commander, downed three enemy bombers in an aerial combat over one of the Dnepr river crossings.

Nikolay Shutt was famous all along the front for his courage and skill. I was particularly pleased to hear of his constant victories. The fact is that I once recommended to the commander that he be given an award; and now I was glad that I was not mistaken in the man. I met Nikolay Shutt during the combat near Khar'kov. On some business I flew to the fighter division commanded by Gen. K. G. Baranchuk. On one of the airfields I saw the following picture. One of our fighter groups returned from a mission and landed. But one of the fighter planes remained in the air and for some time performed acrobatics over the airfield. One figure followed another. This was a whole cascade drawn boldly, beautifully, confidently. One could see that a great master was controlling the plane. Many people had gathered on the airfield and all of them — from the commander to the ordinary engine mechanic — admired the pilot and regarded his piloting as if it were a usual occurrence.

"Has he been assigned the mission to pilot over the airfield?" I asked a pilot who was standing next to me.

"No mission at all. In an aerial combat the group downed many planes. He downed two, it seems, and now he is announcing it to us. This is a kind of salute in honor of his victory."

Hero of the Soviet Union, Guards Capt. A. V. Lobanov, relaxing in the circle of his combat friends. This was on the day when Lobanov downed his 26th enemy plane (1944).

To be frank, this liberty seemed superfluous to me; but noticing how pleased the aviators were, how proud they were of their comrade's skill, I excused it in my thought and agreed with the commander who had permitted the pilots such a fancy.

In the evening, listening to stories about an aerial combat with a large group of enemy planes, I noticed that Nikolay Shutt's name was mentioned more often than that of others. Undoubtedly this pilot had distinguished himself in battle and — what is more — he had been the soul of the combat.

On entering the mess hall I noticed that cooks and waitresses bustled about the good food for the pilots. One table was laid separately: there were dishes prepared with special care, as if intended for one who was celebrating his name day.

"One might think you were welcoming a guest of honor," I said to the man in charge of the mess hall, pointing to the separate table.

"Comrade General, there is a tradition in our unit: we lay a separate table for the pilot who has distinguished himself in combat. He is, so to say, our name-day man. Today Nikolay Shutt distinguished himself in battle. He often celebrates his name-day with us.

"Who established such a tradition?"

"No one did it, it came of itself. The workers of the mess hall want to thank the hero — and besides, the pilots themselves enjoy it."

After supper I invited Shutt for a talk. A stately, fair-haired, handsome fellow of the rank of Senior Lieutenant, appeared before me. He looked as I imagined a hero-pilot would.

A few months later I learned that the division commander had recommended him for the title of Hero of the Soviet Union.

Now, during the days of battles for L'vov, I heard of Shutt's new exploits and I rejoiced in his success.

Many pilots, who had distinguished themselves in the engagements near Stalingrad, during the battle in the Kursk bulge, in fights for the liberation of the Pravoberezhnaya Ukraine, were awarded the distinguished title of Hero of the Soviet Union.

I remember a conversation. On the far approaches to L'vov on the bank of a small river I was waiting for my turn to get on the ferry with the river-crossing commander officer I. Dmitriyev. Seeing a crowd of soldiers at the ferry, I suggested to the Lieutenant to disperse and camouflage the men.

"If you fear an air raid of the enemy," he said to me, "you are mistaken. Our planes are patrolling in the sky."

He pointed to a group of four of our fighters which was flying by.

"But there may be more planes of the enemy and they will break through to the river-crossing."

"They won't, Comrade General", Dmitriyev replied with confidence, "That time has passed."

Suddenly, as if in confirmation of our conversation, a large group of German bombers appeared on the horizon. We counted 24 planes. Our fighters, flying at great altitude, attacked the enemy from above. The multifold quantitative superiority of the enemy did not scare the four brave men. They confidently attacked the lead group of planes; then, having broken up the formation, they began to select their own definite targets. An aerial combat began. One after another, before reaching the target the bombers dropped their bombs and flew back. A Ju-87 detached itself from the group and at great speed swooped toward the river-crossing. But our fighter followed it closely, overtook it, and shot it up. The Ju-87 fell close to the bank.

An hour later I was on the airfield from which planes were taking off to guard the river-crossing. I asked to see the pilots who had taken part in the unequal combat.

"Squadron Commander Capt. Lobanov," one of them introduced himself.

The Star of the Hero was displayed on the pilot's tunic. His face still retained traces of a recently vanished smile. "He is a jolly fellow", I thought and suddenly remembered that about a year ago I met him in the Belgorod area. He then was playing the accordion in a circle of friends. It seemed to me he was a young pilot, just beginning the war. And now... a hero, squadron commander, terror of Fascist pilots.

"You got the Hero for the Kursk operation?"

"Yes Sir, Comrade General!"

"Do you still play the accordion?"

Lobanov became embarrassed, as if we had been talking of some of his weaknesses.

In the evening I attended flight critique discussions conducted by Capt. A. V. Lobanov with the pilots of his squadron. He related simply and in detail about aerial combat. The captain spoke about the tactics of the enemy, about the necessity of creative approach in the matter of solving combat problems, showing keenness of wit and resourcefulness.

When the day of combat work was over, the pilots assembled in a dugout. By the light of a cartridge shell wick flashed the rows of mother-of-pearl bass keys and the tune of the "Polar Waltz" was heard. It flowed like the waves of the northern sea about which the song was telling.

"Our captain likes songs of the sea," said somebody next to me. I sat and thought how remarkable our men were: they knew how to live beautifully, to struggle and win.

I was always sorry that after each meeting of this kind parting was sure to follow.

Hero of the Soviet Union Guards Maj. Petukhov (1944).

War-time paths of life often took people in different directions for ever. Each one had his own work, his own fate in store for him.

If the enemy offered stiff resistance in Pravoberezhnaya Ukraine, one can imagine the furious bitterness with which he tried to hold L'vov — the largest administrative and political center of Western Ukraine, the junction of eight railroad lines, a city beyond which Poland began. The German Fascist command concentrated large forces in the L'vov area. On near-by airfields 700-720 planes were based.

Very fierce battles were expected. Yet the Soviet troop command showed reasonable caution. Front headquarters was seeking for ways and means to attain victory involving the minimum losses in equipment and manpower. From experience we knew that even important victories could be won at the expense of little bloodshed. This demands a thorough knowledge of the enemy — of his strength, disposition, and plans. Now the most complex problems were rising to full height before all types of reconnaissance. Air reconnaissance was faced with a particularly hard work. At one of the meetings the Front commander said to us members of the Air Army command:

"No important operations for the liberation of the city will be undertaken until reconnaissance — first of all, air reconnaissance — submits a complete picture of the situation in the hostile camp."

Reconnaissance was being made night and day on aircraft of all branches of aviation. Pilots carrying out the missions exhibited much imagination, skill, and courage.

Preceding the operation, reconnaissance photographers alone photographed an area of 17,000 square km. From reconnaissance photographs, 30,000 various defense objectives of the enemy were interpreted. On the basis of this material, maps of separate sectors were being drawn up; many other documents which played an exceptional part in conducting combat operations were being prepared.

Maj. Gen. of the Air Force I. S. Polbin (right) with Chief of Staff Maj. Gen. F. I. Kachev (1944).

One can say that here, for the first time, not only special reconnaissance units were working both on a broad scale and accurately according to a strict plan, but also subunits assigned in all groups.

Before starting to liberate the city, several of the enemy's bases of operation had to be destroyed. The participation of reconnaissance subunits in this particular area was of special importance, owing to frequent changes of the combat situation. Every day combined arms and aviation commanders as well needed information about the location of new firing points, dumps, and important objectives. Aviation group, unit, and reconnaissance outfit commanders maintained direct contact with ground commanders and supplied them with new data. Reconnaissance planes flew in any kind of weather, appearing where they were not at all expected.

On those days, in addition to reconnaissance, our pilots conducted continuous patrolling operations over ground troop combat formations. Once a fighter group, headed by Guards Maj. Petukhov was carrying out such a mission. At a distance of 10 km from the position of our troops on enemy territory the fighters noticed from afar a large group of "Junkers" aircraft escorted by four FW-190's. The Guardsmen's attack was so swift that most of the bombers turned back and only four of them, escorted by one fighter plane, engaged in combat. All the five planes of the enemy were downed and as they were plunging downwards they exploded over their own troops. As to Petukhov's group, it returned to its airfield without any losses.

The offensive against L'vov was planned for 14 July, but already by the 13th the retreat of German troops in the direction of Sokal' had been noticed. Fascist troops were withdrawing beyond the Bug. It was clear that the Hitlerite command was trying to lead its units out of our artillery and Air Force strike zone. First Ukrainian Front commander I. S. Konev issued the order: right flank troops must pursue the retreating enemy without allowing him to consolidate his position on the second defense line. On 14 July troops at the front changed over to the offensive on the central line of advance.

Heavy fighting developed in the Zolochev-Plugov-Zborov area on the central sector of advance. Here the Germans concentrated three tank and one mechanized divisions. The advance of our troops was delayed, and some units found themselves in an exceptionally difficult situation. A certain number of additional planes had to be assigned to assist them. The army commander ordered the scrambling of reserve air units and an increase in combat sortie intensity. On this day our pilots made 4350 sorties. A rain of rocket and gun missiles, an avalanche of bombs were falling on the heads of enemy soldiers, on tank, artillery and mortar combat formations. Soviet Air Force massed strikes on 15 July altered the situation to such a degree that already on the 16th it was possible to move First Ukrainian Front mobile units into the breakthrough. This is what the front commander said of this day's Air Force operations: "On 15 July at a critical moment, the Air Force saved the situation of the 38th Army."

As usual, the glorious "infantrymen of the air" — the ground-attack planes — distinguished themselves. The ground troops CP announced: "Not far from the main line of resistance the enemy has concentrated a large tank task force. A counterattack is expected."

"Foil the counterattack!" ordered the Air Force group commander. Ground-attack planes are taking off into the air. At definite intervals group after group head for the tank concentration area, drop their bombs, and fire on the targets.

A fighter group headed by regiment commander Capt. S. D. Luganskiy, Twice Hero of the Soviet Union, escorts the ground-attack planes. Fighter planes vigilantly scan the sky. But it is clear of enemy planes; the Soviet Air Force lords it unchallenged over the sky. Only now and then down below, much lower than the ground-attack bombers, an enemy fighter will fly past; but, seeing the reliable escort, it does not engage in combat. However, Fascist pilots often avoid a combat also in those cases when our ground-attack planes or bombers are unescorted. The Hitler "aces" have lost some of their arrogance, their tactics have changed. As thieves, getting into somebody's house, first think how to get out of it, in the same way German pilots fly at low altitudes, always ready to flee from Soviet fighters. Now the Germans attack like thieves too when they come upon a solitary, defenseless target. But Soviet planes fly mostly in groups, under a powerful cover — whereas Goering's lauded "aces" travel by devious routes and over the woods. There is no trace of their former arrogance or impudence!

Twice Hero of the Soviet Union Guards Capt. S. D. Luganskiy (1944).

The tactics of our ground-attack planes, bombers, and fighters change too: "One must look down more, and not let the enemy attack one stealthily!" Escort fighters receive the order: "Look for the enemy close to the ground, carry on combat in hedge-hopping flight!"

Germans resorted to provocation as well. A plane or two fly above, while down below an element or squadron of "Messers" lies in wait. We got wise to these tactics too.

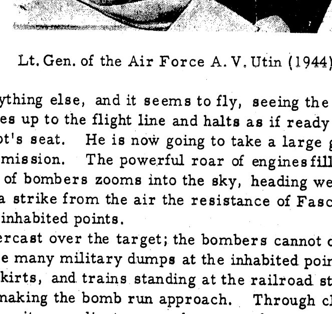
Air supremacy passed entirely into our hands. Yet even now each mission demanded great skill and courage. An AA shell fragment shattered a landing gear wheel, the shell pierced the wing and wedged the aileron of Lt. Leonidov's plane. Pilot and gunner could leave the plane by bailing out, but Communist Leonidov, a squadron Party organizer, took the ground-attack plane in for a landing. In this case it is not easy to land a heavy machine, but the brave pilot carries out the landing successfully. A few hours later Leonidov is in the air again, once more ground-attacking the enemy. On this day ground-attack planes destroyed more than 90 tanks of the enemy.

On those days the tank brigade deputy commander would say to me:

"Each height is a firing point. Artillery mortar positions are located on the many forest fringes here. When our offensive began the Germans introduced into battle a great amount of equipment. And at this difficult moment we again saw ground-attack planes over us — our comrades-in-arms, our neighbors from above. They pressed upon the enemy in large groups. What a formidable force! The pilots' impetuosity and heroism also inspired us — tankers, infantry and artillerymen."

Bombers were not inferior to ground-attack planes either. During the battles for L'vov I happened to be on airfields where bomber units of Gen. I. S. Polbin, the legendary hero of the Great Patriotic War, were based.

...The red regimental banner flies over the airfield. Fluttering like a flame,



Lt. Gen. of the Air Force A. V. Utin (1944).

it rises above everything else, and it seems to fly, seeing the squadrons off to battle. A dive bomber taxies up to the flight line and halts as if ready for a jump. Gen. Polbin is in the pilot's seat. He is now going to take a large group of planes on a scheduled bombing mission. The powerful roar of engines fills the environs of the airfield and a wave of bombers zooms into the sky, heading west. Their mission is to wipe out with a strike from the air the resistance of Fascists who had dug in at one of the large inhabited points.

There is low overcast over the target; the bombers cannot dive. General Polbin knows that there are many military dumps at the inhabited point, artillery and motor vehicles on its outskirts, and trains standing at the railroad station.

The planes are making the bomb run approach. Through cloud rents they see the target, determine its coordinates... and scores of medium and large bombs fall on the enemy. A column of smoke rises over the Hitlerite strong point.

Fighter planes of groups under the command of Maj. Gen. of the Air Force A. V. Utin, Maj. Gen. of the Air Force M. M. Golovnya, and Col. A. I. Pokryshkin distinguished themselves in the battles for L'vov.

Here for the first time we mention Gen. Utin's name. The young generation of pilots, now serving in the ranks of the Air Force, must know that this highly competent aviation commander and first-rate pilot has trained a whole galaxy of famous air soldiers. Heroes of the Soviet Union A. I. Pokryshkin, G. A. Rechkalov, D. B. Glinka, N. D. Gulayev and dozens of others grew and matured in his units.

Having become first-rate pilots and carrying on combat traditions, Gen. Utin's wards in their turn raised masters of aerial combats. A.I. Pokryshkin has an exceedingly great number of pupils and followers. The fame of the "Pokryshkin school" spread throughout the Soviet Army. He who wanted to follow Pokryshkin had to adhere to the following rules: the fighter plane must find the enemy and destroy him; quantity does not determine the success of battle, but rather the skill to strike with dead certainty, resolution and exact calculation in battle — these are the highest qualities of a fighter.

And further — a defective radio station on a plane is the worst enemy. A sortie on such an aircraft is a crime. The soldier who does not know his weapon thoroughly is no soldier.

These rules contained the principles of an advance school of aerial combat.

Communists were in the front ranks, while non-Party people strove to earn in combats the distinguished right to join the ranks of the Communist Party. On the days of the L'vov operation 1527 persons were admitted into the Party. These were pilots, navigators, aircraft specialists, soldiers and officers of rear area units who had distinguished themselves in carrying out combat missions.

The following figures tell of the tension and scale of Air Force combat activity in the L'vov operation. In 16 combat days the pilots of our army made more than 33,000 sorties; carried out 578 aerial combats in which they downed 592 enemy planes; dropped on the heads of the enemy over 17,000 aerial bombs and fired over 100,000 rocket and gun missiles. The intensity of aviation fire was so great that one bomb and six shells burst in every circle with a 10 m radius.

All the efforts of the Fascist German command to hold L'vov were foiled. The L'vov task force of the enemy was half-encircled and on 27 July it was liquidated.

The Soviet Army offensive, developing in the second half of July 1944 on a vast front — from the Gulf of Finland to the Carpathian mountains — was continuing. Combat operations were being shifted to the territories of Poland, Czechoslovakia, Hungary and Yugoslavia. The front was approaching the eastern borders of Fascist Germany.

SOVIET HELICOPTERS

Ten years ago, in Moscow, our own helicopters were for the first time taking part in an aerial review. They had been built by a design team under the leadership of I.P. Bratukhin. Since then, at almost all reviews, we see new Soviet helicopters, improved every year. Thus, at the review in 1955 Yak-24 twin rotor helicopters were already flying. Available here are also the small coaxial scheme machines of the N.I. Kamov design team.

Helicopters of the M.L. Mil' design team — the Mi-1 and Mi-4 — are widely used in the USSR. They are being used in the Air Force and in many branches of national economy. The Mi-4 found large-scale application for geological survey work in Arctic and Antarctic pioneering expeditions. With their help hundreds of people were saved during floods and disasters at sea. Helicopters are being applied more widely in transport, particularly in medical transport, in liaison service, in the struggle against agricultural pests and forest fires.

Soviet helicopters are not only not inferior to foreign ones in their performance

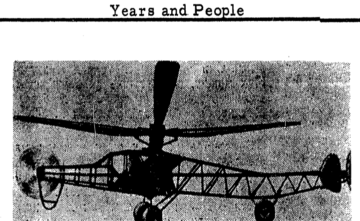
The Soviet TsAGI 1-EA helicopter in flight (1932)

characteristics, but in a number of features they are considerably superior to them. Established records are graphic evidence of this.

In 1955 pilots G.A. Tinyakov and Ye.F. Milyutichev on a Yak-24 helicopter established two world records: altitude and carrying capacity. In 1956 on the Mi-4 helicopter two world records were also broken.

A remarkable record was established in 1957 by pilots R.I. Kaprelyan and G.V. Alferov on the new powerful Soviet Mi-6 helicopter, developed by a team of designers under the leadership of M.L. Mil'. They lifted a load of 12,004 kg to an altitude of 2432 m, exceeding the record of the American pilot Roy Anderson (1956) by twice the amount. Such successes could be attained owing to the high level of Soviet science and to the technical equipment of our industry. They are the quite natural result of the work of many years of a large team of scientists, designers, engineers, pilots, mechanics and workers, which was carried on in our country in the domain of propeller aircraft for more than 30 years.

Already in 1927 there appeared in TsAGI [Central Aerohydrodynamic Institute] the first and only — at that time — scientific-research and design group for building helicopters.



The Soviet Mi-6 helicopter with turboprop engines (1957).

Five years later (1932) successful test flights of the first Soviet TsAGI 1-EA helicopter took place. This was much superior to aircraft of a similar type in use at that time.

Its immediate creators were Prof. A.M. Cheremukhin, Engineer K.A. Bunkin, and the author of these lines. Engineers I.P. Bratukhin, G.I. Solntsev, A.F. Maurin and V.P. Lapisov, who were young at that time, took part in a series of research projects.

The first mechanics of our own helicopter, I.D. Ivanov and S.A. Trefilov, earned deep gratitude for their work.

The 1-EA helicopter was built according to a basic plan suggested by B.N. Yur'yev as far back as 1909-1912. Most helicopters are being built even now in our country, as well as abroad, according to this plan.

Test flights were conducted from 1930 to 1934. Prof. A.M. Cheremukhin continuously served as a pilot on the helicopter. He made a great number of flights, demonstrating a straight-up takeoff, vertical climb, "hovering" in the air, a strictly vertical let-down and landing on a pre-selected point, motion forward and to the sides, any kind of turn while "hovering" over a specified spot.

On 14 August 1932 Prof. Cheremukhin ascended on the 1-EA helicopter to an altitude of 605 m. This was a record result at the time. The officially registered altitude record set by the Italian helicopter "Ascanio" was only 18 m.

It is quite natural and understandable that the experience obtained as a result of building the first Soviet helicopters — TsAGI 1-EA, TsAGI 5-EA, TsAGI 11-EA — and autogiros has served as the basis for designing new and improved machines. The Soviet Mi-6 helicopter with turboprop engines is a new achievement in the practice of helicopter building in the entire world.

Candidate of Technical Sciences,
A.M. Izakson

THE WIFE OF A PILOT

MIKH. PETROV

They were expecting a child in pilot Sergey Prokhorov's family. Prokhorov's wife, Natasha, had lately become particularly worried and even a little sad.

Whenever Sergey's colleagues or neighbors met him, they would more and more often inquire about his wife's health, expressed their good wishes and asked him what he would like to have: a son or a daughter. Embarrassed, Sergey would answer:

"If a boy is born — it will be o.k. If it's a girl — it will be good too..."

Natasha's mother, Anna Vasil'yevna arrived from Chelyabinsk. She was a bustling, elderly woman who brought into the couple's life a particular homelike atmosphere.

Natasha had taken a leave of absence. There were always flowers in the room; her girl friends from the school where she taught brought them, but most often it was Sergey. Walking across the field on his way home from the airfield he would always pick a big bunch.

"Why do you pick so many flowers? I have nowhere to put them," Natasha would say, but the glance she cast at her husband was warm and affectionate.

Once Sergey came home beaming and excited. He related that their element had been declared outstanding, the general had expressed his appreciation and rewarded him with a watch bearing his name.

"But this is already the third watch with your name inscribed on it. What shall we do with them?"

"Have you forgotten our son, Natasha?"

"What if it's not a son, but a daughter?"

"It will be a son, a son," — Sergey repeated insistently. "It must be a son. You know, I'll most certainly teach him to fly. Fancy: we are at home and our son appears in the door-way — robust and happy, in his hands he has flowers, but they are peculiar, they have a strange smell...

" 'This is for you, mother, I brought them from Mars' — he will say. 'I picked them myself...'

" 'From Mars?' we utter perplexed.

" 'It is quite simple. I took some tourists there. Now give me something to eat: I had breakfast long ago, and now it is almost dinner time.' "

"You are a dreamer, you always invent something," Natasha laughed.

* * *

The Prokhorovs called their son Mikhail. Sergey was in seventh heaven. Of course! His dream had come true. To his comrades' questions as to what it was, he would answer tersely: "Mishka, and he weights almost four kilograms."

Capt. Prokhorov even lost weight. The pilots joked: "Things do happen: it cannot be helped — he is a 'nursing father'." Joking was all very well but family matters worried Sergey. As long as there was no child — everything was clear and simple. Now they had a son and he imperiously demanded his rights. Natasha's leave of absence was over and everything became more difficult for her. In the morning, having fed Misha, she hastened to school, then she appeared at dinner time and left again. Returning from his flights Sergey often found his son crying loudly. Anna Vasil'yevna, walking about the room with him kept repeating: "Don't cry, my darling, mother will come — she'll nurse and soothe you."

One evening Prokhorov made up his mind to have a heart to heart talk with Natasha.

"Here at last, you and I have come to have true, great happiness", he said. "Now you must quit working to take care of our son..."

"Leave school?"

"Of course. What do you need it for? Bring up Mishka, meet me when I come back from flying — this is now your main calling, so to speak, your duty towards the community and the State. In a word, you are a mother, and that is most important."

A minute of silence followed. It seemed that each one was thinking his own thoughts. What was to be done to avoid an imprudent step, so that life would be interesting and meaningful as before?

Natasha approached her husband and, taking his hand, said:

"You know, Serezha, though I am a mother, I have other duties, too. I am accustomed to work, I love the school and it would be hard for me to part with it and, after all, why did I go through college?"

"I do not understand you," Sergey said indignantly. "Other women dream of such a life. What else do you need?"

"I cannot agree with them," Natasha replied quietly. "For me the aim of life is not only this."

"But I am guarding your peace and our son's childhood... The school, children, all the bother with the backward ones, checking their home work — all this is burdensome for you."

"You are speaking of some kind of peace for me," said Natasha staring at her husband. "I am not eager to have such peace, I don't want it. It may be hard for me, but as long as mother is staying with us, I won't give up work."

This was said firmly and Sergey was surprised: this was the first time he had ever seen his wife like this. He tried to prove to Natasha that her leaving work would be only temporary, Misha would grow up and she would return to school again, but all was in vain.

"You don't love your son," said Sergey angrily.

Suddenly Natasha was silent. She looked into the corner of the room where her son's crib was standing, then she slowly raised her glance to her husband and her face changed, it became gentle and bright. She approached Sergey and murmured softly, as if afraid of waking her son.

"You are both dear to me, Serezha, I love you both."

* * *

Service in the Air Force is not very easy. But with maturity the pilot acquires composure, self-control, self-reliance and, along with them, one more precious quality — daring, the ability to take risks.

All was going well with Capt. Prokhorov. His element became the leading flight section in the unit. The element pilots, officers Loganyuk, Roshchin, Lomakin, loved their profession very much and flew with inspiration, carrying out their missions excellently. Yet Prokhorov often pondered — was this enough?

He considered that each pilot should constantly improve his skill and look for new methods of aircraft combat employment.

"Look, my friends," he once said after flying, sitting down on the grass and inviting the pilots to do the same. "I want to consult with you. You know how difficult it is under present conditions to approach a target. Radar facilities and PVO [AA defense] are strongly developed. What if..."

Having outlined toss bombing by fighter planes of which he had already heard, Capt. Prokhorov suggested that they should master this method. The pilots discussed their commander's plan at great length and with enthusiasm, they made their own suggestions, they argued and did not notice that dusk had fallen. The decision was taken — the entire element would get to work!

At home Prokhorov briefly related to his wife the difficult problem which now absorbed the pilots of his element and asked for her help (Natasha had graduated from the department of mathematics and physics). Now he envied her knowledge of mathematics!

"You should eat something first", Natasha advised. But Sergey did not even want to listen.

He drew diagrams, crossed them out, drew again, wrote down formulas, substituting coefficients, added and multiplied; that evening he and Natasha sat up late, bent over the table and checked calculations.

In the morning, when Capt. Prokhorov was on his way to the unit HQ he had in his pocket the complete calculations for different variants of toss bombing.

At headquarters Prokhorov stated his plan in detail and on the same day the group commander summoned him.

Having listened to Prokhorov attentively and after thinking over his suggestion, he decided:

"Good! I authorize the experiments, but won't you need other pilots for this, too?"

"Such pilots are to be had, Comrade General."

"Who are they?"

"All the pilots of our element."

"How good are they?"

"They are eagles!" the captain said with confidence.

"Won't these eagles turn out to be gray quails in reality?" The division commander looked searchingly at Prokhorov.

"I will vouch for them, as for myself, Comrade General."

"All right! This is the answer I expected from you. I know pilots Roshchin, Loganyuk and Lomakin, they won't let you down."

The commander took a slide rule, checked the accuracy of a few calculations and asked after a short pause:

"Who checked the mathematical calculations connected with bombing?"

Prokhorov answered proudly:

"My wife, Natasha!"

"Your wife?"

"Yes, my wife!"

"What, is she an engineer?"

"No, she is a teacher and knows physics and mathematics well."

"Your wife Natasha", said the general smiling. "It is good when pilots have such wives. Tell her that I am very grateful to her for her help."

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Experimental flights began. On the plan chart appeared: Capt. Prokhorov's element flies according to a special plan. The Party organization secretary was interested in the results of the flights and helped the pilots in every way.

Capt. Prokhorov, Lts. Roshchin, Loganyuk and Lomakin became enthusiastic about the flights and did not notice how fast time was going by.

A month of experimental flights was coming to an end, but the results were not comforting: bombs dropped either short of the target or far beyond it.

Sergey became sullen, reserved, gloomy, and even his face grew thin. Evenings he would sit late into the night over his notebooks and manuals, drawing, figuring and checking. He would go to bed late, stayed awake long, his dreams were troubled.

"What is the matter?" thought Sergey. "Why are the results so poor?"

He became irritable and even short-tempered, which he had never let himself do before. Natasha did everything she could to help her husband. She knew that it was hard for him and that a new task had complicated the already difficult work. She realized that a pilot always had to be cool and self-possessed — that is the main thing in his profession. At times with a joke or a smile and with her self control she helped her husband to recover his good mood, she encouraged him and made him believe in success.

One evening Sergey sat up particularly late. When the clock struck midnight he jumped up and said loudly"

"Well, that's it!"

"What are you talking about?" asked Natasha, quietly sitting with a book on the sofa.

"Natasha, is that you?"

"Yes, Serezha."

"When did you come in?"

"About nine o'clock, as soon as I put Misha to bed. And didn't you notice? Well, have you solved it at last?"

"Yes, now I have solved it and, perhaps, conclusively."

"That's good: your torment will be over..."

"And your troubles, too. I decided to stop all the experiments. In the morning I will go to headquarters and will give up: evidently I do not have the capability..."

Natasha looked at her husband anxiously. She suddenly recalled a resolute, strong-willed Sergey. She remembered his stubborn day-after-day toil, his search for a solution to a difficult problem. Yes, this is how men and their characters are tested. She did not find it strange that at this moment in her mind rose pictures of courageous Soviet men, strong in spirit, persistent and iron-willed.

"Aren't you ashamed, Serezha", said Natasha, trying to speak as gently as possible. "After all, you are a strong man..."

"What is the use of such strength! For 30 days we have been flying back and forth in group or individual flights, and what are the results? I feel ashamed even to look my comrades in the eye."

"You must look!"

"It is easy for you to say so, sitting on the sofa... You get into the cockpit in my place!"

"Each of us has his problems. In my teacher's cockpit it is also not always cozy and pleasant. You got scared of the very first failures. Are you afraid to look your comrades in the eye? Don't be afraid of that. No one will blame you for not having succeeded in everything at once. But if you stop half-way, lose heart and swerve from your course — beware! Then where will you turn your eyes?"

"But why doesn't it work out? How to determine the moment for pulling the plane up out of horizontal flight and the point of bomb release?"

"Serezha, did you consult with the other pilots — Roshchin, Loganyuk?"

"They have had the same results."

"Never mind, you must keep on trying. Do you think that those who split the atomic nucleus got everything at once? They had still greater difficulties. And you are ready to flee from the battlefield after the first failures."

"I, flee? Never! You know what the general told me when I saw him? 'Won't these eagles turn out to be gray quails in reality?' As it happens, I am the quail, and a plucked one at that..."

"No, Serezha, you are just tired and that is why you lost faith in yourself, but the main thing..."

"What is the main thing?"

"The main thing is that you should consult people more — you have dozens of Communists — they will help you, and don't you lose hope. Then our Misha will fly to the moon and Mars sooner. It is you who predicted this for him", Natasha smiled.

* *
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Sergey and Natasha entered the club. In a prominent place in the hall hung a photograph of pilot Prokhorov. Natasha was the first to notice it.

"Serezha, read it! It's about you."

On a huge plaque the following was written: "Capt. Prokhorov's element achieved excellent scores in toss bombing. In aerial gunnery matches Capt. Prokhorov took first place, scoring 595 points. Flying in pair with Capt. Sumin, he intercepted the target 100 km from the airfield. Firing at a ground target, he hit it with a large number of shells. Capt. Prokhorov trains his subordinates skilfully and is the commander of an outstanding element. Comrade pilots, follow Capt. Prokhorov's example!"

When the Prokhorovs took their seats and the lights went out, Natasha said softly:

"I am so happy now. I am proud of you, Serezha."

"And I am proud of you," answered Sergey, slightly embarrassed, and as if recalling a long forgotten conversation, he added:

"It is not only of me they write there. It's of both of us, you and me, Isn't that so, Natasha?"

TECHNICAL INSTRUCTION IN CLASS

At the beginning of the year we held instruction classes for the flying personnel in matters of technical training. The classes were lively and interesting and proved very useful to the flying personnel. Yet they required quite a lot of work: it was necessary to consider carefully the class program, to select instructors with practical experience and sufficient theoretical training. The flying personnel had to be divided into two groups, according to the level of their knowledge.

In a special classroom the following aircraft equipment was displayed: an electromechanical trainer simulator of an airborne radar intercept station, a trainer for call signs of homing radio stations, an operating electrical layout for starting the engine, a mock-up of the fuel system, of oxygen equipment, etc.

The commander was worried that they might waste flying time because of the classes. So that this would not happen the pilots flew additional days preceding and following the classes; in this way the total number of flying hours during the month did not change.

It is better to hold such classes at the beginning of the winter and summer periods. But this is not enough. No less than one day a week should be devoted to technical instruction. A combination of classes and systematic ground training is very useful.

In units based on dirt airfields it is better to organize classes during the spring thaw, when there is no flying. In the above-mentioned air group, the classes were held for a short period of time. So that the instructors would have time to conduct classes in several units, they changed to a two-day schedule. At first classes were held in one unit only, two days later — in a second unit, and then in a third.

In the course of technical training, after class the main consideration was given to subjects directly associated with the coming flights. Much time was spent in the trainers. Owing to such studies the pilots began to carry out training exercises and flights much more successfully.

V.I. Vinogradov

FROM THE EDITOR'S MAIL

HOW TO AVOID A DROP IN ENGINE RPM AT HIGH ALTITUDES

In flying aircraft equipped with VK-1A engines at high altitudes, a drop in maximum rpm is sometimes observed. We were able to eliminate this shortcoming by replacing the ART-8V [automatic fuel regulator] unit. However, for a long time the reason for the failure was obscure, inasmuch as no divergence from technical specifications was found in testing the units removed and in disassembling and measuring the parts.

The following incident helped to reveal the cause. On one engine, the rpm fell from 11,560 to 11,200 at a high flying altitude. In testing the dismounted unit in a pressure chamber, it was found that in a vacuum corresponding to an altitude of 14,000 m the valve of the automatic accelerator functioned at a fuel pressure of 7.5 kg/cm^2 instead of at a pressure of 8-10 kg/cm^2.

Displacement of the valve of the automatic accelerator at lower fuel pressure led to premature discharge of the fuel from the spring housing of the servopistons of the plunger pumps and to a reduction in their output. The amount of fuel fed to the injection nozzles was reduced, and under the conditions of high-altitude flying this caused a drop in the maximum rpm.

Consequently, the difficulty in the operation of the engine was due to imprecise adjustment of the ART-8V unit on the stand after its repair and assembly. How then explain the drop in rpm in such cases?

A number of forces act on the valve of the automatic accelerator. It is known that the air pressure behind the compressor fluctuates and varies within a very wide range — from 3.52 to 4.7 kg/cm^2. This affects the fuel pressure, which opens the valve of the automatic accelerator.

With rise in altitude, there is a drop in atmospheric pressure and the pressure behind the compressor. Up to an altitude of 11 km the latter declines somewhat slower than atmospheric pressure due to an increase in the degree of compression of the air in the engine. At altitudes above 11 km the degree of pressure no longer increases, and the air pressure behind the compressor drops faster — in direct proportion to the density of the ambient air.

The unit is adjusted and tested on a special stand both after it is built and after it is repaired. Consequently, the pressure of the air in the air filter of the ART-8V depends on the installation and not on the engine. Its magnitude is constant and comprises 4 kg/cm^2. But the units shipped out by the plant or a repair enterprise are adjusted at a specific pressure of the air which enters the chamber of the automatic accelerator on the side of the spring. Thus, the engine will function normally only when the air pressure behind the compressor is 4 kg/cm^2.

The situation is different when the air pressure behind the engine compressor is less than 4 kg/cm^2 — let us say 3.52 kg/cm^2 — and the automatic accelerator of the ART-8V is adjusted at the lower limit (for example, the pressure for opening the valve of the automatic accelerator for an altitude of 10 km is 26.0 kg/cm^2 at the lower limit). Then the valve of the automatic accelerator will operate at a fuel pressure below the lower limit, since the pressure of the air on the side of the diaphragm chamber is less than at the time the unit was adjusted on the stand. This phenomenon, as we convinced ourselves, is the cause of the drop in engine rpm at high altitudes. If, however, the pressure behind the compressor is great, on the order of 4.7 kg/cm^2, and the automatic accelerator is adjusted at the lower limit (according to technical specifications), then the gate of the accelerator valve will already open at a higher fuel pressure, because on the side of the air chamber it will in fact be greater than that at which the adjustment was made. Consequently, from the lower limit the adjustment will approach the upper, but will still be within the technical specifications, and the engine will function normally.

Now when releasing the unit, we check without fail the pressure of the air behind the compressor, and if it is below 4 kg/cm^2 we adjust the ART-8V at the upper limit of high altitude characteristics. In this way we have been able to eliminate the drop in engine rpm.

Senior Engineer Lt. D. Ye. Bugrov

AN INSTRUCTIVE ANALYSIS

The aircraft made a landing. Upon inspection it was found that the hatch cover of the tank filler was missing. What was the reason? This occupied the thoughts of the engineer of the unit, V. N. Pisarev. Experience suggested to him that since such an incident had occurred, then, apparently, there was a weak link in the system of checking the condition of aviation equipment. Possibly the checking was superficial and no check was made to see if the hatch cover was closed; or else the mechanic was not attentive enough during the inspection.

It was necessary to devise measures to prevent such instances in the future. To this end the following procedure was established. During preliminary servicing, the technician together with the electrician and specialists from service groups first inspect the aircraft completely. The irregularities found are entered into the aircraft flight servicing log. And only after the inspection is completed do they begin to eliminate the defects. The unit commander forbade diverting personnel from work associated with inspection of aviation equipment. The flight technician checks the work of his subordinates. He writes down the deficiencies noted in his work log, so as to analyze them later during the technical critique.

Another thought came to mind. Should not the entries in the aircraft flight servicing log be made more specific? Instead of a general phrase that the post-flight inspection had been made, the engineer now requires that the item numbers of the unified regulation check-list by which the defect had been corrected be indicated. The aircraft technician signs to the effect that that specific item has been taken care of, while the flight technician verifies it. The technical personnel began to study more thoroughly the documents in the unified regulation check-list and the

procedure of aircraft inspection. However, there were not enough of these documents for all. On the order of engineer Pisarev, the pages giving the procedure of aircraft inspection were photostated. Pocket-type books were made up of these photostats and were distributed to each technician. Now all the work is done in strict conformity with the inspection procedures. Flight technicians began to check more purposefully the quality of aircraft servicing.

Similar measures were undertaken for the other services also. As a result, it was possible to eliminate many shortcomings, and the number of failures of aviation equipment was halved.

To work out the inspection sequence, a trainer was built in each squadron. This trainer is a wooden model of the aircraft on which the numbers of the check-list items are entered in different colors, corresponding to the inspection sequences. Green represents post-flight inspection, blue is preflight inspection, and white is flight-line inspection. Such a trainer plane has been extremely useful in integrating young technicians into the outfit.

Thus did Viktor Nikolayevich Pisarev analyze as a true engineer the loss of a hatch cover and draw conclusions that made it possible to improve checking the condition of aviation equipment.

Engineer Lt. Col. N. G. Grigor'yev.

USE OF A PORTABLE RADIO DIRECTION FINDER SCOPE BY THE FLIGHT CONTROLLER

Modern radio and radar facilities make it possible to obtain sufficiently accurate data on the air situation, but the flight controller gets most such data on request.

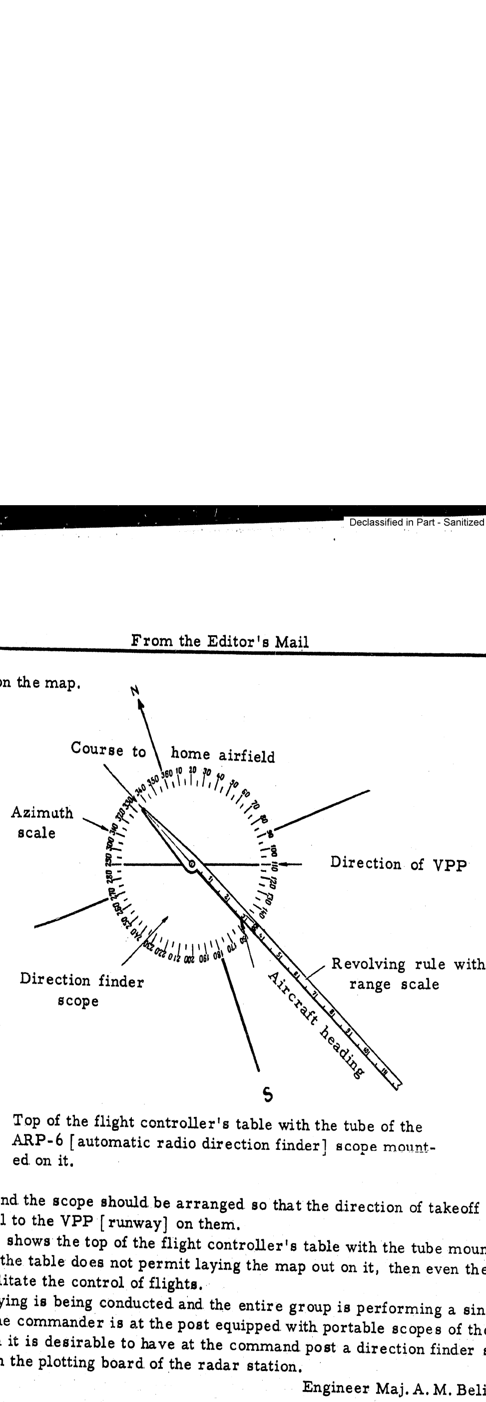
Although the route is laid out on the plotting board, which is located right beside the flight controller, nevertheless this does not give him a complete picture of the air situation. The most important sector in which the flight controller must know the air situation is the area of the airfield (approximately within the radius of the large circle). But it is this sector, as a rule, that coincides with the "funnel" (zone of silence) of the radar station, and the flight controller gets no information from the radar on the aircraft in this zone. The landing system scopes are also outside his field of vision.

In some units the scope of the portable radio direction finder is combined with the plotting board of the radar station. This facilitates in some degree the control of flights, but it still has some shortcomings.

We think that, in ordinary flying, of all the radar facilities the flight controller needs only the portable scope of the radio direction finder.

If the portable scope had two tubes, one of them could be combined with the plotting board for the use of the ground controller on duty and the other could be used by the flight controller. In the version with one tube, in our opinion, it is desirable to set up the portable scope near the flight controller.

For this it is necessary to detach the cathode-ray tube from the unit and mount it on the flight controller's table; around it to place the azimuth scale and a map of the flying area; and in the center of the tube to place a movable rule with a range scale. Then, knowing the aircraft's azimuth and range, it is possible to determine its position on the map.



Top of the flight controller's table with the tube of the ARP-6 [automatic radio direction finder] scope mounted on it.

The map and the scope should be arranged so that the direction of takeoff and landing is parallel to the VPP [runway] on them.

The figure shows the top of the flight controller's table with the tube mounted in it. If the size of the table does not permit laying the map out on it, then even the tube alone will facilitate the control of flights.

If group flying is being conducted and the entire group is performing a single mission, while the commander is at the post equipped with portable scopes of the radar stations, then it is desirable to have at the command post a direction finder scope combined with the plotting board of the radar station.

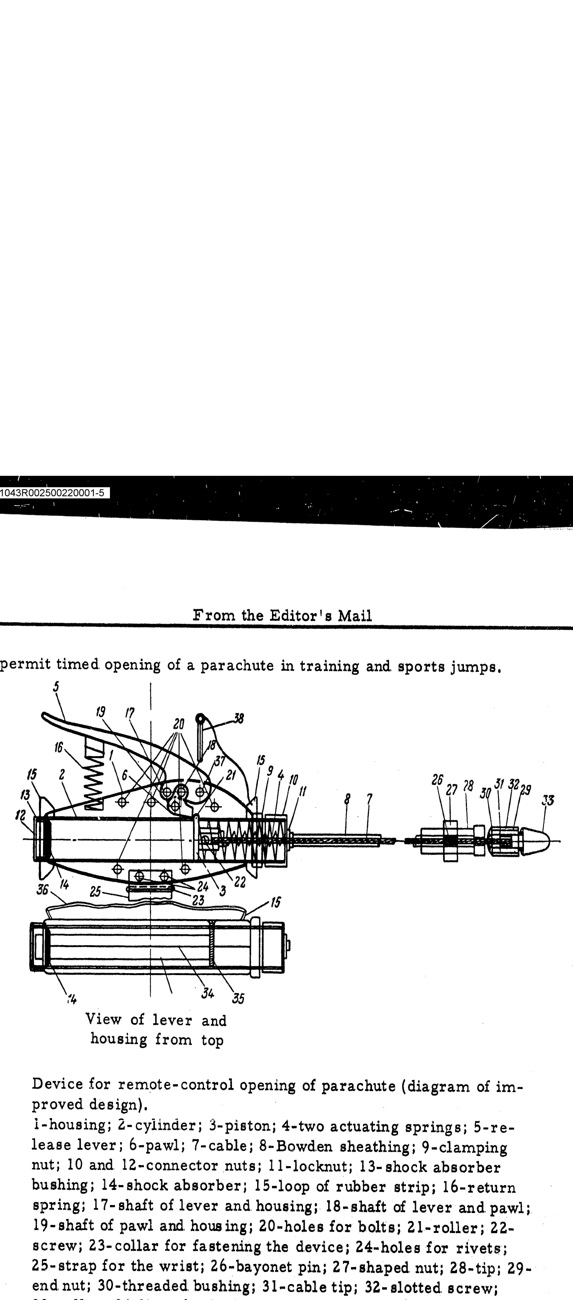
Engineer Maj. A. M. Belikov

A DEVICE FOR REMOTE-CONTROL OPENING OF A PARACHUTE

Among our parachutists there has recently come into widespread use a new remote-control method of opening a parachute that permits keeping the body strictly prone, face down. In other words, the parachutist does not have to bring together his separated arms, search for the rip cord ring, and pull it at the prescribed time. He need only press a release lever to open the parachute.

Now used in the VVS [Air Force] are several types of semi-automatic devices

that permit timed opening of a parachute in training and sports jumps.



Device for remote-control opening of parachute (diagram of improved design).
1-housing; 2-cylinder; 3-piston; 4-two actuating springs; 5-release lever; 6-pawl; 7-cable; 8-Bowden sheathing; 9-clamping nut; 10 and 12-connector nuts; 11-locknut; 13-shock absorber bushing; 14-shock absorber; 15-loop of rubber strip; 16-return spring; 17-shaft of lever and housing; 18-shaft of lever and pawl; 19-shaft of pawl and housing; 20-holes for bolts; 21-roller; 22-screw; 23-collar for fastening the device; 24-holes for rivets; 25-strap for the wrist; 26-bayonet pin; 27-shaped nut; 28-tip; 29-end nut; 30-threaded bushing; 31-cable tip; 32-slotted screw; 33-collar; 34-line of split housing; 35-screws; 36-rubber strip; 37-hole; 38-safety catch.

The kinematic diagram (see figure) shows one of the recommended devices. The principle of its operation for remote-control opening of a parachute is based on the action of the springs (4) with a reserve of potential energy in the compressed position. The device is attached to the palm of the right hand by means of a rubber strip (36) and is set in operation by a sudden, instantaneous pressure on the release lever (5) by all the fingers (except the thumb). In this, the piston (3), held by the pawl (6), in a cocked position, is set in motion by actuating the springs (4); being connected to the upper pin of the rip-cord ring of the parachute through the cable(7) and collar (33), it opens the parachute pack. A KAP-3 safety device is mounted on the parachute as usual, only on the left.

The remote-control device for opening a parachute does not prevent using the main rip-cord ring. Its small size does not disturb the style of drop and permits executing all the figures in the delayed jump. This semi-automatic device is very simple in design; it is made of 38 parts, 21 of which are taken from the KAP-3, which simplifies manufacture considerably.

The aluminum housing (1) in which the entire mechanism is contained is made of two symmetrical parts held together by five steel screws (35). The total weight together, with the Bowden sheathing (8), is 250-300 g.

The compressive force on the release lever in raised position is about 3 kg, while the force of the actuating springs, which pull the pins out of the cones of the parachute pack, is less than 25 kg. After the release lever is pressed, the device opens the parachute pack in less than 0.1 second.

In order to use it in jumping, it is necessary to sew a plate to the top valve on the right of the pack with a six-strand linen thread (just as for the KAP-3) in such a way that there is an angle of 40° between the plates. The bayonet pin (26) is fixed to the plate in the same manner as on the KAP-3; the actuating springs of the device are also cocked the same way.

The cotter key safety lock is removed from the device in the plane at the command "Prepare to jump", and with its cord is stuck under the rubber strip, after which the parachutist, observing the safety rules, takes the initial position for jumping from the plane.

Senior Lt. V. P. Vartazarov, parachute instructor

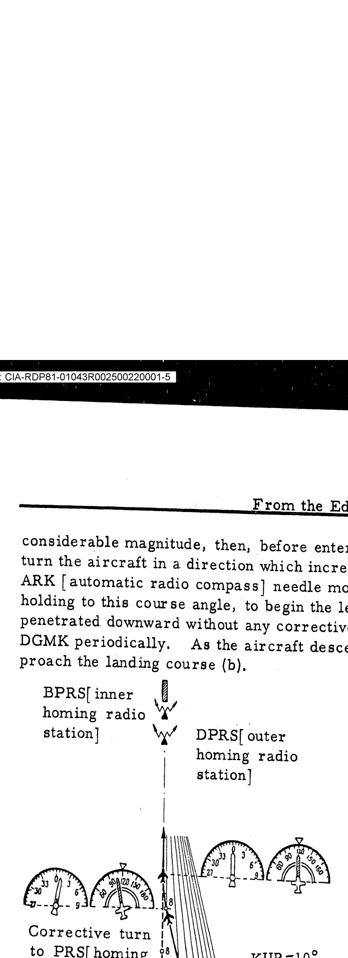
LETDOWN TO LANDING COURSE ALONG A RADIODROME

The approach for landing under adverse weather conditions is a most difficult and important stage, completing as it does the flight mission. On the last straight leg after the computed turn, the pilot, flying on instruments, penetrates the cloud cover downward in the direction of the outer homing radio station. All his attention at this period is concentrated on holding to the prescribed letdown regime. With a cross wind and a deviation from the landing course, piloting the aircraft in downward penetration of the cloud cover is difficult. In addition to holding to the letdown regime, the pilot is compelled to correct for errors in course and to take into consideration the angle of drift.

In order to correct for errors in course, appropriate corrective turns are made to one side or the other, as shown in the figure, (a). Execution of such corrective turns, as well as the choice of lead in course for the angle of drift, especially when flying in a cloud cover, distracts the pilot's attention from holding to the prescribed letdown regime and not infrequently leads to undesirable consequences.

However, there is no need to correct for errors in approach in this manner. Our experience in flying has shown that if the turn to the homing radio station is completed earlier or later, i.e., if the course at KUR [course angle to radio station] = 0° differs from the landing course by $\pm$ 20° or more, then it is necessary to let down along a radiodrome with a constant course angle of the radio station. For this purpose, it is necessary to proceed as follows.

After the turn it is necessary to head the aircraft toward the homing radio station (KUR = 0°) and to determine the magnitude of the course error. If the readings of the DGMK [long-range gyromagnetic compass] diverge from the landing course by a considerable magnitude, then, before entering the cloud cover, it is necessary to turn the aircraft in a direction which increases the course error in order that the ARK [automatic radio compass] needle moves 10° in the opposite direction and, holding to this course angle, to begin the letdown. In this case the cloud cover is penetrated downward without any corrective turns. The pilot can glance at the DGMK periodically. As the aircraft descends, the readings on the DGMK will approach the landing course (b).



Trajectory of aircraft movement along a radiodrome and the accompanying instrument readings.

At the moment when the ARK and DGMK needles diverge at an equal angle (10°) in different directions, it is necessary to turn the aircraft to the homing radio station. This in turn will result in the aircraft's having a flying course equal or close to the landing course.

Piloting a plane in penetrating the cloud cover downward is simpler by this method. Maintaining the ARK needle at 10° from the zero position presents no difficulty to the pilot. Although the letdown to a landing course along a radiodrome does occur with a gradual corrective turn of the aircraft the pilot actually does not feel this turn.

Before the aircraft enters the landing course there is no need to counter the drift, since in the final analysis it will affect only the character of the radiodrome. Depending on the force and direction of the wind, the aircraft will come out on the landing course sooner or later. At the end of the radiodrome, i.e., at the moment the aircraft approaches the landing course line, the pilot need only turn the plane toward the homing radio station by 10°.

This method of letdown, furthermore, shortens the track and the time the plane spends in the clouds, eliminates cases of aircraft getting close to each other in penetration of the cloud cover by a group, especially from high altitudes. It can be used on all types of aircraft during the approach to a straight-in landing with any letdown regime.

Engineer Maj. A. M. Mikhaylov,
Military Pilot Third Class

REVIEW AND BIBLIOGRAPHY

WINGED HEARTS

Notes on belles-lettres for 1957 devoted to aviation

In our achievement of victory in the Great Patriotic War, an important role was played by the Soviet Air Force. Many truthful and heartfelt books have already been written about our glorious pilots and about their combat assistants — the mechanics, engine mechanics, men of the Air Force rear area. Writers have been emphasizing through the medium of literature the fact that the secret of the fearlessness and invincibility of Soviet pilots lies not only in powerful equipment made in the Soviet Union, but chiefly in the strong wills and the high degree of skill of our aviators.

During 1957 in various publishing houses of the country, more than ten novels, stories and tales appeared dealing with Soviet pilots. They all give a sincere account of ordinary Soviet people for whom nothing on earth is dearer than their Socialist Motherland and who, loyal to their sacred military oath, rise at the first call of the Party and the People to the defense of their country's skies, their country's soil.

The story "The Inexorable Air"[1] by I. Arsent'yev is interesting.

The author tells about events with which he is well acquainted. Consequently it it not by chance that the portraits of the military pilots appear so convincing. They are all fellow officers. They fought together over the Northern Caucasus and over the beautiful Crimea, scorched by the sun and by the war. After carrying out dozens of exploits, many of them ended the war over Berlin.

In the title of the story, the basic theme is brought out, as it were: the air, the inexorable air. It is not just the cloudless blue of the sky which we admire in days of peace; it is a threatening element, hot with the explosions of anti-aircraft shells; it is the site of ruthless air skirmishes. And the strongest man is victorious in these skirmishes. The one that maneuvers skilfully, the one that is irresistible in swift attack, the one that does not lose his composure and the noble feeling of mutual assistance, the one that is confident of the cause he is defending — that man will win without fail.

Combat experience does not come quickly and easily. The author's merit lies in the fact that he rejected a schematic solution of the theme, was not tempted by an easy portrayal of "ready made" warriors, who had mastered the difficult art of combat — no one knows when and where. The artistic tact of the author helped him present portraits of the main characters as they developed. Following the young

[1] I. Arsent'yev. "The Inexorable Air". A story. Kuybyshev, 1957, 328 pp, price: 6 rubles, 15 kopecks.

pilots with interest, the reader sees them become toughened gradually from skirmish to skirmish, and sees well-deserved success come to them after initial failures.

One of the best, most successful portraits is that of Grabov, the regimental commissar. There is none of the bluntness in Grabov with which some writers at times endow political workers (incidentally, we may say, in a completely artificial manner). A pilot by calling, and in essence a Communist, Grabov is in no way outstanding in his outward appearance. He is rather stout, in an ordinary leather raglan overcoat, and in heavy soldier's boots. That, at least, is how he was seen for the first time by the young guardsmen when the commissar came to their quarters to become acquainted with them. And from their first brief conversation, it became clear that before them was a man who was congenial and close to them in a fatherly way. Along with a grim, strict, exacting concern, there is also a feature in Grabov's character that raises him above everything that is petty and personal — his high-principled Party zeal. Life belongs to the common cause, and once that is accepted, then a Party conscience and, for example, self-love — which does not admit of self-criticism — cannot exist together.

That is why, when the young men, who had just arrived in the regiment, saw like boys only the romantic aspect of an episode where they observed Grabov's damaged "Little Star" return to the airfield, the commissar expressed himself candidly and even with excessive sternness towards himself:

"How did I fly? I botched it. Once the craft was disabled, that means I flew badly."

As though answering the surprised glances of the pilots, he explained: "It was bad because getting back to the base on a wing and prayer is an uncertain business. That's only superficial heroism, I think... I recommend avoiding it."

"Why then, did you purposely expose the craft to German shells?" asks Ostap, and in his naive question, childish mortification for the commissar, as well as an attempt to justify him are very obvious. To the inexperienced pilot it seems that the commissar is casting aspersions upon himself.

In reply Grabov gave a barely noticeable smile: "Purposely or not, the reason is simple: my bomb run was set up wrong... Come to the CP this evening, and I'll give a critique of this sortie."

Grabov's conduct is a striking and instructive example. Many have been learning skill and endurance from him. Communist Boroda, whom Grabov used to take along as his wingman, was also learning from him. Later, in battles over Etilgen, Boroda, with more than one "viper" already to his personal score, was shot down. Although wounded, he continued fighting the Fascists in the ranks of amphibious landing forces, and he died the death of a hero.

Arsent'yev paints the picture of the commissar with sure, sparing, but expressive strokes of the brush. He depects him in various situations, to which also the psychological reaction of the hero precisely corresponds. In the air Grabov is an inexorable avenger, a skilful commander. On the ground he is an intelligent older friend, able to warm one with a smile, give support with his advice, and, if necessary, to criticise as well. Thoughts for his comrades under his command do not leave the commissar in the evenings at the campfire or in any temporary hut. A sense of responsibility for the life of his fellow-officers is strong within him.

"In war, of course, where death lurks at every step, casualties are unavoidable", he thought. "Casualties, but not senseless suicide as the result of underestimating the enemy. Let's just take Olenin as an example. He's brave, that goes without saying, but that's not it...he's a big show-off. He's young. He likes to create an external impression occasionally..." (p. 46).

As a teacher Grabov comes to light especially clearly on the pages devoted to a regimental Party meeting. Through the specific errors of Olenin and Popov he explains the harm of a false notion about heroic deeds.

Grabov does not confine himself to criticism but notices in time a change in character on the part of a subordinate and encourages him by his confidence. Thus, it is precisely to Olenin first that he entrusts the test flight of a new two-place craft that the regiment had received.

The image of the commissar emerges alive and penetrating. Throughout the entire story he justifies the author's characterization: "Grabov was deeply convinced that you can direct men's thoughts and actions in conformity with the will of the Party only when you yourself merge with the group and become its soul." (p. 45).

There are many episodes in the story which reveal the high combat morale of Soviet pilots, their friendship, mutual assistance, and pure faith which helps them endure all.

Pulya's plane caught on fire. He could have bailed out without exposing himself to unnecessary risk. But in the gunner's cabin was a wounded man — Umanskiy. Fighting the fire, Pulya, badly burned, manages to land the plane. Lt. Popov, at the risk of danger to his own life, lands on enemy territory near the commissar's "Little Star" which had been shot down, thus saving the commissar from certain death.

Another character in the story unexpectedly reveals his genuine worth. Here is Lt. Averin. He has neither a good nor a bad reputation, only some unpleasant traits: He doesn't know how to make friends and likes to show off... But at the decisive moment he repeats Gastello's exploit, directing his burning fighter plane at Hitlerite tanks...His friends hear a tense, hoarse voice in the headphones: "This is Averin calling...Farewell, comrades! For the Motherland!"

The reader senses a deep moral purity in the personal life of the pilots, in the feeling of the love proven by fire between Ostap Pulya and the girl armorer Tanya, and between Vasiliy Cherenok and Galina Puchkova, the sister of a tankman whom he had saved.

The story has many plots. It does not just contain the unique chronicle of one regiment only. The pilots do not live and act in isolation. Their combat and personal lives are closely interwoven with the fate of many people: tankmen, infantrymen, kolkhoz workers, doctors, etc.

However, from time to time, Arsent'yev goes off key in a tone unusual for him. For example, a trivial little anecdote sounds doubtful on the lips of the Ukrainian Ostap. Similarly a vulgar remark about military medical assistant Sof'ya Nikolayevna is out of character for Cherenok. It seems to us that such details do not add to the beauty of the story.

Interesting characters of fighter-guardsmen were created by V. Bogovitskiy.[2]

[2] V. Bogovitskiy. "Winged Guard". A story. Kazgoslitizdat [Kazak State Literary Publishing House]. Alma-Ata, 1957, 211 pp., price: 4 rubles, 85 kopecks.

The author has succeeded in reproducing the spiritual life of his characters in vivid, honest pictures. It is difficult to name the main character, for there are several persons at once in the center of the narrative: Major Orlov and Lt. Col. Panfilov, the regimental commander; Pilots Iskrin, Bagin, Beloded, and others. The images do not overshadow one another. They help present more fully the entire friendly team of the regiment, purposeful in its goal of victory, the characteristic features of its individual members, and their manifold social and personal interests.

The theme of training young aviators in the rigorous conditions of the front has been embodied organically in the contents of the story as one of the basic threads of the plot.

The image of Regimental Commander Panfilov is significant and full-blooded. A Hero of the Soviet Union, he is worthy of emulation. Every pilot is mentally proud of him and strives to resemble him. Inner composure bespeaks the integrity of his character. This integrity has been reflected also in his external behavior, as well as in his manner of dealing with his subordinates. He is exacting but not faultfinding, he inflicts punishment justly, but does not consider the guilty man incorrigible.

During the period of training for combat, Iskrin, already a seasoned pilot, suddenly revealed an important error: he would become carried away too much by the attack and as a consequence would not always be capable of carrying on the battle soberly and judiciously. The commander noticed this at once and realized why Iskrin was bringing his plane out of a dive at a low altitude. In addition to the commander's reprimand, we see Panfilov constantly helping Iskrin to temper his will and not give in to dangerous enthusiasm, to control himself in any situation.

Panfilov does not just require his men to fulfill their mission exactly. We feel what a noble influence the commander exerts upon the pilots, encouraging in them a feeling of human dignity.

In Orlov who became Panfilov's successor by the end of the story, the fine soul of a Soviet man trained by the Party is displayed before us. Not a single enemy has the power to defile and sully this soul, to abase or to destroy it — it is indeed immortal.

The picture of Maj. Orlov is successfully supplemented by his love for Katya, the radio operator, and by his adoption of the orphan Anya, who even by her name reminds him of his own little daughter who, together with her mother, had perished during a bombing raid. Orlov's feeling is shown in an unforced manner, warmly, with restrained power. The love of a widowed man is painful and deep in precisely that way.

The picture of Capt. Tasoyev has proved to be an essential defect in the story in our opinion. In his person recurs the routine tendency to portray a staff worker negatively. No one asserts, and indeed it could probably not be proved, that there have not been and are no negative people in the world, and that there are none on staffs or among pilots. For example, in the story "The Inexorable Air", Skvortsov is depicted realistically, a coward and scoundrel who, just to be one the safe side, picked up a German leaflet calling for surrender to the mercy of the enemy. The pilots unmasked him and he would not have escaped their judgement; but Skvortsov's own cowardice brought him to his own distruction.

The case is different with Tasoyev. Of course he is not to be compared with

Skvortsov; he is a negative type of a different kind. He is not a potential traitor, perhaps, not even a coward. But what we have in mind is the character in its psychological development. Tasoyev's negative qualities — excessive ambition, a perfunctory attitude toward his duties, etc. — are only stated by the author. Even though Tasoyev is by far not an episodic character and an important part of the plot is connected with him, he "barely glimmers" on only a few pages and on the whole seems unreal and fictitious. Chief of an operations section, he cherishes one goal: to become chief of staff, to obtain as many medals as he can. His egotistical ambitions somehow remain unnoticed by the team. Finally even the author himself waves Tasoyev aside by citing a dry report as to his fate (the captain's legs were torn off during a bombing raid, when he was on his way to attend a course for chiefs of staff). This mechnical device by which the author closes the book on Tasoyev, indicates best of all the static nature of the character.

In contradistinction to the preceding stories, Yu. Ryshkov's novel, "Captain Bystrova"[3], can be considered as a work about one hero. It is well known that during the period of the Great Patriotic War, Soviet women showed their worth not only on the home front, laboring selflessly for defense, but participated directly in battles, serving in various branches of the Army. The deeds of our glorious women pilots will never be forgotten.

We still have a noticeable dearth of works about women who were frontline soldiers, including women pilots. Ryshkov's novel is an encouraging sign. Captain Bystrova is a composite character taken from life. The story of the life of the woman pilot during the war is told with great lyricism, a life which calls to mind the life of many of her frontline women companions-in-arms.

The reader becomes acquainted with the heroine for the first time when she flys patrol over Soviet ships proceeding on their course under the sure fighter cover of Naval aviation. The end of the artistic biography of Capt. Bystrova coincides with the logical dénouement of the plot of the book: victory has been won, a promising peaceful vista has opened up before the heroes, the fulfillment of new cherished desires awaits them and they continue to live a full life — but, to the regret of the readers, beyond the limits of the novel.

It was not easy for Bystrova at first. She still remembers with shame one of her first combat sorties, when, having been overtaken by "Messerschmitts" and fired upon from two directions, she did not accept battle but took cover in the clouds. But she expiated this guilt during her entire subsequent life and struggle. And many ordeals fell to her lot — in the air, on the ground, and on the sea.

In the air, she always knew that Lieutenants Nikitin, Megrelishvili, and other comrades were at her side; on the ground, on Soviet soil which had been temporarily seized by the enemy, she, a pilot who had been shot down, was aided by ordinary Soviet people, including the old man Koz'ma Potapovich, who accepted the position of village elder upon orders from the commander of the partisans. On the sea, Bystrova is saved by sailor friends: once her "Yak-3" was forced to land directly on the waves near some sub-chasers. She is amicably called "our Natasha" by her

3 Yu. Ryshkov. "Captain Bystrova". A novel. "Dawn of the East" Publishing House, Tbilisi, 1957, 294 pp, price: 6 rubles, 35 kopecks.

sailors, whom she had been vigilantly protecting from the Fascist vultures.

The novel is also good in that two characters, as it were, have been harmoniously blended in one person, in one figure: Capt. Bystrova and then that same "our Natasha" which is the only way her combat friends refer to her among themselves.

War did not kill the human beauty in her. Together with a burning hatred for the Fascists, under whose heel her mother and sister were languishing somewhere, love was born in Natasha's heart and proudly claimed its right to exist. Subcommander Sazonov responds to her love with a simple pure feeling. The development of the plot in the novel is so conditioned by the contents of Natasha's military fate, that after meeting her beloved only three or four times, she is separated from him for many long years. However, whether a regular air battle is going on, or a battle on the ground — a partisan battle in which Capt. Bystrova also takes part — we are sure to hear, through the din of the explosions, the strong pure melody of Natasha's love.

The image of Bystrova is charming also on the pages describing her visit, after being wounded, at the home of the parents of Air Force Doctor Bokeriy. Here, her little friends — neighboring boys — quarrel among themselves on an "awfully important" question "of principle": Is she really the well-known lady pilot who has real medals? And if so, then why does she wear everyday civilian dresses and — horrors! — milk the landlord's goat. Natasha conciliated the boys by coming to the school to meet them in her officer's uniform and, as the saying goes, in full regalia.

While Natasha, or Natal'ya Gerasimovna, or Captain Bystrova, as the central heroine, has been drawn fully and thoroughly, the same cannot be said, unfortunately, about Sazonov and the other characters. Some of them are rather sketchy.

It is also obvious that the plot of the novel could have been better balanced, more finished, by curtailing unimportant details and insignificant ramifications of the plot.

Stories written in a literary-documentary genre were published in 1957. One of them is about the illustrious North Sea pilot Boris Safonov[4], and the other (an abridged version) is about Hero of the Soviet Union Leonid Belousov.[5]

The initiative of the Military Publishing House of the Ministry of Defense, which has prepared and published these stories, must be welcomed, for books about prominent Soviet aviators present great interest for a wide circle of readers.

The above-mentioned stories in general leave a satisfactory impression, but they are not of equal value. S. Glukhovskiy's story was written in a noticeably better manner, on a higher professional level. An energetic style, the ability to single out the main thing and to concentrate the reader's attention on it, a simple language, free of palling literary clichés — all this bespeaks the fact that the author has an adequate mastery of literary technique.

Belousov rises to his full height before us, a trainee of the 151st Regiment of the legendary Perekop Division and a worker at the January Uprising plant. Leonid has grown up together with his native land, studied, and matured. The hour of war struck

4 N. Gil'yardi. "Over the Icy Sea". Voyenizdat [Military Publishing House], 1957, 304 pp., price: 6 rubles, 35 kopecks.

5 S. Glukhovskiy. "Indomitable Heart". The Little Library of the magazine "Soviet Warrior", 1957, 49 pp., price: 50 kopecks.

and, unsparing of his own life, he is defending the Motherland. One cannot read without agitation how, after losing his legs, he strained every nerve of his indomitable heart to return to his friends and fellow-soldiers.

In N. Gil'yardi's story, the figure of Safonov, Twice Hero of the Soviet Union, has been presented in a tangible manner. More than other episodes, those dealing with skirmishes with the enemy are successful, where the pilot's tactical motto is: caution — maneuver — fire. The chapters dealing with the pilot's childhood are also successful.

But in general, in its artistic qualities, the story leaves something to be desired. Its main defect is its occasional affected pedantic style. It is all the more a pity since frequently that style is employed to express sensible and, in principle, indisputable ideas. Without giving a moment's thought to the artistic burden of speech characteristics, the author has an old kolkhoz worker express a grandiloquent tirade in one breath (p. 31).

At times N. Gil'yardi employs the style of a recording stenographer (p. 86) as though forgetting that in a literary work, even if it is documentary, one must not describe the hero as though filling out a cadre registration card on him.

The author's tendency at every convenient opportunity to stress the uniqueness of the hero's talents seems wrong to us. Everything is accomplished readily and swiftly, everything comes easy to him as his due. All he had to do was return home after a trip to Tula "and in some two or three months (that is actually what the author wrote! Yu. L.) the Sinyavin Organization of the Osoaviakhim [Society for the Promotion of Defense and Aero-Chemical Development] became one of the best in the Plavsk Region" (p. 47).

He gave a talk on balloonist Kryakutnoy (incidentally the whole talk is given verbatim!) and on the spot he is told: "That is probably the best talk we've ever heard at our meetings" (p. 64). "From the very first training sessions the detachment commander valued the young trainee's capabilities in the business of flying" (p. 71). "He gained the reputation of being the best agitator during the first months of his stay at the Air Force School" (p. 98). The number of similar instances could be increased, but even the above are quite enough. We feel that the reason lies in the fact that the author did not achieve a deep knowledge of his hero's character.

We would like to mention the brilliant tale "Dubnyy" by V. Trikhmanenko, published in the magazine "Far East" (No. 3), the stories "The Fighters" by V. Mel'nik and "Updraft" by A. Pozdnov, which were published in a second edition, and A. Bek's novel about an aviation designer — "The Life of Berezhkov". An adventure story "The Secret of Temir-Tepe" by L. Kolesnikov has appeared on the bookshelf for this year about trainees at an Air Force school who exposed enemy agents. The story calls upon us to intensify our vigilance all the time.

Let us pause briefly at M. Vodop'yanov's book, "Winged Heroes". It is a collection of short tales, executed by an experienced hand, about prominent aviators. The author introduces us to veterans of the Russian Air Force and to Soviet pilots whose names have already become legendary — Chkalov, Grizodubova, Osipenko and Raskova, Gastello, Pokryshkin, Kozhedub, and many others. In an original manner, the book has shown us, through historical personages, the development of aviation and the triumph of Soviet thinking in scientific engineering and designing.

It is gratifying that many republic and regional publishing houses are putting out literary works about Soviet aviators. But that also restricts their dissemination to definite territorial limits. And many of the above-mentioned novels and stories deserve being brought to a broader circle of readers. It is desirable for the Military Publishing House, for the "Soviet Writer" Publishing House, and for others to help bring that about, by reprinting the more successful works.

During the postwar period, Soviet aviators have achieved great success. The old notions about the limits of speeds have been broken, and unprecedented equipment has been created and mastered.

Let us hope that in the future as well our belles lettres on aviation will be based on lofty Party principles and will foster Communist awareness and patriotism in Soviet men and women. Those excellent qualities are deeply inherent in our great people, and inherent also in its winged sons.

Yu. I. Loginov

LIQUID FUEL ROCKET ENGINES

Among the new aircraft engines that have been developed during the past World War, and particularly during the postwar period, an important position is occupied by rocket engines and their principal variant, liquid fuel rocket engines (ZhRD). The successful development of engines of this type made it possible for Soviet scientists, engineers, and workers of many plants to build and launch artificial earth satellites. In connection with this, even greater grew the interest and attention of aircraft engineers, technicians, and a wide circle of readers in liquid fuel rocket engines.

The recently published work of G. B. Sinyarev and M. V. Dobrovol'skiy, "Liquid Fuel Rocket Engines"[1] provides answers to many questions associated not only with the construction, analysis, and design of ZhRD but also with servicing of engines of this type. In it the reader will find the principles of the theory of liquid fuel rocket engines, information on their classification and fields of application, the necessary data on thermodynamics and gasodynamics, on fuels for ZhRD, on the design of combustion chambers and the processes that go on in them, and other useful information.

The authors of the book tell of the first ZhRD, built in the Soviet Union by F. A. Tsander in the early thirties. In 1939 engineer L. S. Dushkin developed a liquid fuel rocket engine with adjustable thrust for aircraft.

S. P. Korolev's first flight in a ZhRD rocket plane was made in our country in early 1940. (By the way, in the book the date of this event is given incorrectly.) Two years later, pilot G. Ya. Bakhchivandzhi made successful flights in a rocket plane designed by V. F. Bolkhovitinov, on which ZhRD were installed.

The broad scope of the work in building ZhRD facilitated the successful development of domestic rocket engineering. In 1933, the first rocket developed by M. K. Tikhonravov was launched in our country. This occurred much earlier than the first launching of the well-known German V-2 rocket. In subsequent years, the launching of rockets in the USSR was repeated, and the altitude of their flight steadily increased. All this served as an important condition for the launching of artificial earth satellites.

Questions of thermodynamics and gasodynamics (Chaps. II, III, IV) are expounded in this book in their relation to the phenomena in a liquid fuel rocket engine. The characteristics of the operating process are necessary not only for determining the excess oxidizer ratio, the magnitude of which should correspond to the optimal progress of the process of combustion and exhaust but also for the technical servicing of ZhRD power installations, since without this it is impossible to understand what goes on in the engine under changing conditions of its operation.

[1] G. B. Sinyarev and M. V. Dobrovol'skiy, Zhidkostnyye raketnyye dvigateli [Liquid Fuel Rocket Engines]. State Publishing House of the Defense Industry, Moscow, 1957, 580 pages, price 14 rubles, 65 kopecks. Second edition.

By clarifying the processes that occur in the combustion chamber and the exhaust nozzle, it is possible to evaluate the distribution of temperatures and speeds of the gas flow, which is very important for operating the engine and determining its basic parameters, as well as for the subsequent calculation of the cooling of the combustion chamber and the exhaust nozzle. In addition, analysis of the thermodynamic cycle of the ZhRD permits a graphic presentation of the method of operation and the basic features of a heat engine.

The authors devote not a little attention to the choice of fuel as one of the very serious problems studied in the theory of ZhRD (Chap. V). It is known that the chemical propellants that produce energy in combustion consist of two components— a fuel and an oxidizer.

Examined in the book are the basic characteristics of some types of promising propellants. Analysis of Mendeleyev's periodic system has made it possible to select the elements that have the greatest store of chemical energy. On this basis, there have been compiled tables of the thermodynamic properties of the combustion products of all the basic elements that can be used as propellants for ZhRD. However, calculations show convincingly that chemical propellants have a quite definite limit of specific thrust on the order of 380 kg-sec/kg. At the same time, for further improvement of rocket vehicles it is necessary first to increase the specific thrust of the engines. The authors show that great possibilities lie in atomic powered rocket engines.

The methods of thermal calculation of the engine chamber (Chap. VI) are illustrated with numerical examples, which facilitates considerably the mastery of the material expounded in the book and its application in practice.

Together with the theoretical principles of the calculation of cooling liquid fuel rocket engines (Chap. VII), the authors examine the method based on experimental formulas of the theory of heat transfer. They discuss in detail the scheme of external cooling and the form of the cooling channels; they present a number of numerical examples for calculating the elements and assemblies of the cooling system.

The second part of the textbook deals with the designing of liquid fuel rocket engines. It is generally known that the elaboration of each engine design depends on its purpose, the propellant selected, and certain operating data. However, the methods of computing the characteristics of an engine, its design form, size, and heat transfer are usually quite general in nature and, with minor exceptions, are suitable for engines of all types. Proceeding from this, the authors give the model procedure for designing them and analyze the design of individual assemblies.

In addition, a number of questions that may interest the engineering and technical personnel of the Air Force directly are conveniently expounded in the book. Among them are, for example, the process of combustion in the chamber of a ZhRD and the latter's peculiarities, the form of the combustion chamber, the principal requirements in starting and stopping the ZhRD, the fuel system of liquid fuel rocket engines, the individual designs of ZhRD used for different purposes and with different systems of fuel supply, ignition, and stopping.

The book by G. B. Sinyarev and M. V. Dobrovol'skiy can be useful to engineers and technicians engaged in the operation of rocket equipment or specializing in this field.

AVIATION ABROAD

COMBAT APPLICATION OF ROCKET AND REACTION-PROPELLED WEAPONS

In recent years guided reaction-propelled missiles have been occupying an important place in the armed forces of capitalistic countries. As is reported by different sources in the press, development of this type of weapon has proved that it can successfully resolve a great number of combat problems and will find wide application in military operations on land, sea, and in the air.

Guided missiles are under development and have been partially accepted as armament in the Army, Air Force, and Navy of the USA. The different types of guided missiles are divided into appropriate classes, determined primarily by the point from which the guided missiles are launched, and by the location of the target which they are intended to destroy. For instance, missiles of the "surface-to-surface" class are launched from the ground or from naval ships and aimed at ground or above-water targets; those of the "air-to-surface" class are launched from aircraft and aimed at ground, above-water or under-water targets; those of the "surface-to-air" class are launched from the ground or from ships and aimed at aerial targets; and those in the "air-to-air" class are launched from aircraft and directed against aerial targets. This classification is officially accepted in a number of countries.

Characterizing guided missiles by their combat application, military specialists consider missiles in the "surface-to-surface" and "air-to-surface" classes as types of offensive weapons and the missiles of the "surface-to-air" and "air-to-air" classes as defensive. Naturally, the greatest interest in the imperialistic countries, whose leaders engage in aggressive policies, is expressed in the offensive weapons and the possibilities of their use and combat employment. This explains the fact that the "surface-to-surface" class of guided missiles has received the most widespread acceptance in the USA. The missiles of this class in existence and under development are divided by the military specialists of the USA into three categories: tactical guided missiles, intermediate range guided missiles,and intercontinental (strategic) guided missiles.

From the data published in the American press there are at present several types of tactical guided missiles of the "surface-to-surface" class in the weapon arsenal of the armed forces of the USA. The most important of these are: in the Air Force — the guided winged missile "TM-61 Matador" with an effective range up to 1000 km; in the ground forces — the guided ballistic "Redstone" rocket with an effective range of up to 800 km and the ballistic "Corporal" rocket with an effective range of up to 120 km; in the Navy — the guided winged missile "Regulus".

There are no intermediate range guided missiles (not to speak of intercontinental

missiles) in the weapon arsenal of the USA as yet. Judging by the press, trial launchings of intermediate range ballistic rockets, designed for an estimated effective range of up to 2500 km ("Airplane", 10/25/1957), are being conducted on proving grounds. The intercontinental guided winged missile, the "Snark" (Fig. 1), is being prepared for acceptance as armament. Use of atomic warheads is planned for all of the above-mentioned guided missiles — including those for tactical employment — and hydrogen warheads are planned for intercontinental missiles.

The question as to how effectively the problems faced by the armed forces can be solved with the help of this new armament causes animated discussions among American military specialists. A number of characteristics possessed by the guided missiles of the "surface-to-surface" class leads some foreign military leaders to the conclusion that these missiles are capable of resolving almost any of the missions now carried out by piloted aircraft, and that in a short time they will be able to replace modern bombers. They point out that it is possible to hit targets under any weather conditions with the help of guided missiles. In addition, their application will not be limited by the availability of regular airfields.

Fig. 1. Launching of the SM-62 "Snark" guided winged missile.

Nevertheless, a great number of military specialists in the USA are of the opinion that guided missiles of the "surface-to-surface" class are at their present stage of development only an auxiliary weapon for aircraft and cannot replace them. In support of this belief are quoted such arguments as insufficient (in view of great dispersion) accuracy of guided missiles in hitting small-scale targets, the impossibility of their employment against moving targets, and the present inadequacy of their control and guidance systems.

Since tactical guided missiles of the "surface-to-surface" class have been issued as armament to the US Army comparatively recently, and since there are no intermediate range guided missiles and no intercontinental rockets in the armament of combat units, the problems of their combat employment have not been solved. On the other hand, the very fact that some types of missiles have been developed and accepted as armament for units is a proof of the existence of quite definite plans for their employment.

For instance, some views on the application of guided missiles of the "surface-to-surface" class have been expressed on the pages of the "Air Force" magazine by the Chief of the USAF General Staff, Operations, Maj. Gen. Bergquist. According to his statements, launching installations of intercontinental guided missiles, intended for striking the most important objectives deep behind the lines of a potential enemy, will be located throughout the territory of the continental US in such a way that it would be impossible to destroy a majority of them with one blow.

Fig. 2. Launching of a TM-61 "Matador" guided winged missile.

Launching installations for intermediate range guided missiles will be located, in his opinion, in such a way as to insure the destruction of the greatest number of enemy targets and to insure the least vulnerability of their own positions. This rather general idea has been recently given substance. At the last session of the Council of the aggressive North Atlantic bloc, American military leaders openly demanded of their European partners in the bloc that both stockpiles of atomic weapons as well as rocket launching pads be located on their territories. Intermediate range ballistic rockets of the "Jupiter" and "Thor" type were under discussion at that meeting. American military bosses are planning to construct launching installations for guided missiles on the territories of France, Italy, Denmark, and Norway with a clear intention of making sure that targets in the Soviet Union and the peoples' democratic countries are within their reach.

Intercontinental guided winged missiles and ballistic rockets, as well as intermediate range ballistic rockets, are expected to be used mainly in strategic aerial operations in close cooperation with strategic aviation. The main principle of the employment of such missiles is thought to be their mass application simultaneously against a great number of targets deep behind the enemy lines. It is thought that the greatest effect can be achieved by employing rocket weapons to destroy targets with strong anti-aircraft defenses, in cases when enemy aviation has mastery of the air, and also when the employment of bomber aviation is limited or made impossible.

The view is also expressed in the press ("Air Force", Sept 1956) that the study of the territory of a potential enemy makes it possible to divide his rear-area targets into two types: permanent targets, or even groups of such targets, occupying comparatively large areas; and important small targets widely dispersed over a large territory. The character of the latter and the former puts, in the opinion of the magazine, different demands on the means of aerial attack. Since intercontinental ballistic missiles and

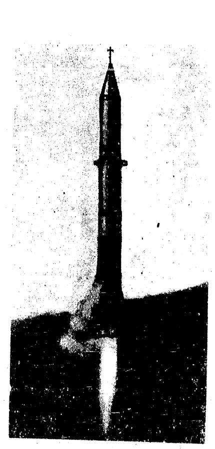


Fig. 3. Launching the guided ballistic "Redstone" missile.

intermediate range missiles do not as yet possess sufficient accuracy, it is proposed that they be used mainly against large area targets (or groups of them) located in a comparatively small region. It is pointed out that one of the essential requirements for their effectiveness is the determination with the greatest accuracy of the coordinates of the target and of the launching installation from which the missiles are to be launched ("Military Review", March 1957). In other words, large war industry and administrative centers, whose coordinates, as is pointed out, are not hard to establish, are to be earmarked as such objectives.

Guided missiles of these two types will not be capable, in the opinion of some authors, of carrying out the principal task in a strategic operation which is the destruction of the facilities of aerial attack by the potential enemy, since the facilities will be located on dispersed launching bases and airfields — targets too small, under present conditions, for guided missiles of this type. Destruction of such targets will be mainly effected by aircraft possessing the required maneuverability and hitting accuracy.

Some military specialists maintain that intermediate range guided ballistic rockets of the "Jupiter" and "Thor" type can be attached to an army group in a theater of war, to be employed in its interests.

The problem of location, dispersal, and camouflage of launching sites is directly related to the combat employment of guided missiles of the "surface-to-surface" class. It is quite natural that launching sites for intercontinental guided rockets and intermediate range rockets, numerous and bulky launching equipment, as well as the rockets which themselves have structures of considerable size will be rather easily spotted from the air and will serve as good targets for the enemy's bomber aviation. The American military press proposes that launching sites be located in a mountainous region which would limit the field of observation, in structures located deep underground or even under water. It is recommended that the most easily recognizable structures (concrete pads with a regular outline, symmetrically laid approaches, fuel storage containers) be carefully camouflaged from reconnaissance from the air.

Tactical guided winged missiles and ballistic rockets are intended by the American Armed Forces for employment in theaters of war for the purpose of the support and security of operations by the ground forces. However, the combat employment of various types of these missiles can be different both in nature as well as in the tasks assigned. The deciding factor in this problem is the mobility of a given type of guided missile and its effective range. Judging by the opinions expressed by military specialists, tactical guided winged missiles in the armament of the units, such as the TM-61 "Matador" (Fig. 2) and the "Redstone" ballistic rockets (Fig. 3), which have an effective range of 800-1000 km, will be employed mainly to destroy large targets behind the front lines (railroad junctions, concentrations of troops and military equipment, army depots); they will also operate against airfields of combat aviation, artillery, large calibre gun emplacements, and means of atomic offensive located within the limits of their striking distance, i.e., they will perform those tasks which were previously assigned to tactical aviation.

Insufficient strike accuracy and limited maneuverability of these means of destruction make their employment against small-scale and moving targets almost impossible. For the purpose of increasing their strike effectiveness it is proposed to equip these missiles with atomic warheads.

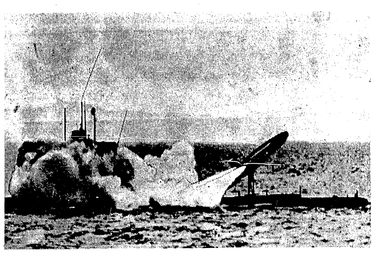


Fig. 4. Launching of the "Regulus" guided winged missile from the submarine "Tunny".

According to concepts formulated by military leaders, guided missile sub-units are to be attached to field and air armies, especially for operations under adverse weather conditions.

The experience in employing existing units of "Matador" guided winged missiles shows that they are intended by the Air Force staff to give support to their tactical aviation in theaters of war, and are put at the disposal of the Air Force commanders. Therefore their organizational form is a wing, consisting of three squadrons with five launching installations in each. At present, a wing of "Matador" guided winged missiles has been formed in Western Germany and attached to the commander of the USAF in Europe ("Interavia" No. 8, 1957).

The "Corporal" tactical guided ballistic rockets, with a range of 120 km, have a somewhat different application. Being also a weapon attached to a field army in theaters of military operations, they are called upon to carry out tasks which they share with aviation and artillery. The comparatively short range and high strike accuracy make it possible to employ these against targets located directly on the battlefield as well as against those behind the zone of corps reserves.

Military specialists in the USA believe that under the conditions of an atomic war, which will be characterized by rapid changes in the situation and the operations of the troops employed in dispersed and extended combat formations, guided missiles of this type will be able to give support to the troops in any weather without changing firing position in periods of deep penetration and at critical moments of the battle.

Installations for launching them must be located, not in the immediate vicinity of the front, but behind the lines in such a way as to make it impossible for the enemy to seize them by surprise in case of a sudden breakthrough or infiltration through the combat formations. Since the "Corporal" rockets are Army weapons, their organization is reminiscent of that in the artillery. Initially, "Corporal" battalions had an organization completely similar to artillery battalions, i.e., they consisted

of a headquarters battery and several firing and service batteries. Each battalion contained about 600 enlisted men and officers.

According to military specialists, experience showed that such organization is too bulky and lacks maneuverability. Now a battalion of "Corporal" rockets has a personnel of 250 men and consists of a headquarters, a service battery, and one firing battery ("Interavia" No. 8, 1957). It is proposed that each field army will be reinforced with three battalions of "Corporal" rockets. At present several battalions of "Corporal" guided rockets with similar organization are located in Europe as part of the ground forces of the USA.

The "Lacrosse" tactical guided missile, recently accepted as armament in the US Army, has an effective range of up to 16 km and is designed for direct fire support of the troops in the field. Battalions of "Lacrosse" missiles are expected to be included in the ranks of corps or even division artillery.

Leaders of the US Navy are also intimately concerned with the problems of employing guided missiles of the "surface-to-surface" class.

US Naval experts believe that guided missiles are the basic form of future naval weapons and that their employment on warships will increase the strategic capabilities of the Navy and will make it possible to deliver strikes on targets located at large distances from the shore, i.e., to increase the fire power and the combat capabilities of ships. At the same time ships can divert such weapons rapidly in any direction from which danger threatens. Some specialists express the opinion that a ship equipped with guided missiles of this class will represent too tempting and vulnerable a target for the aircraft and guided missiles of the enemy. Others on the other hand are inclined to think that this opinion is not sufficiently convincing, in view of powerful methods of anti-aircraft defense, including guided anti-aircraft rockets with which warships are armed.

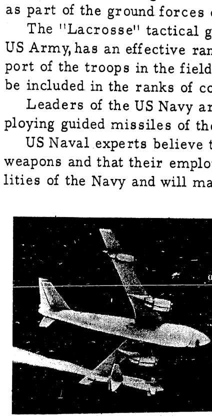


Fig. 5. Launching of a "Rascal" guided winged missile from a B-47 "Stratojet" bomber.

Many military specialists in the US believe that the possibility of employing guided missiles will enhance the role of the submarine fleet in carrying out strategic operations. Submarines with atomic engines, which considerably increase their cruising autonomy and range, will make it possible to employ guided missiles with particular effectiveness, insuring sneak delivery of this weapon to enemy shores and bombardment of targets very far behind enemy lines.

Installation of guided missiles on submarines does not require extensive modification in their construction. Only the torpedo equipment is replaced by a launching device, a guidance system, and an airtight hold for storage of one or two missiles.

At present the US Navy possesses warships and submarines armed with guided missiles of the "surface-to-surface" class (Fig. 4).

Arming of the US Navy with guided missiles proceeds mainly in two directions: construction of new ships specially designed for the use of such weapons; and modification and reequipment of existing ships. In addition to warships under construction, which are designed to use guided missiles, the shipbuilding program of the US Navy in the 1957/1958 fiscal year provides for the construction of 8 destroyer escorts, 5 destroyers, and 3 atomic submarines, specially equipped for this purpose ("Navy Times" 5/28/1957).

Desire on the part of the US Navy to decrease the vulnerability of guided missiles of the "surface-to-surface" class and to preserve the greatest surprise in their employment led to the design of a guided missile launched from a submerged submarine. According to the press, some US firms are already working on the development of such a missile, which has been given the name of "Polaris". The proposed range of its flight is reputed to be 2400 km. It is believed that the missile will serve as the armament for submarines with engines driven by atomic energy. ("Interavia Air Letter", 10/25/1957).

The class of guided "air-to-surface" missiles has a different function. It is planned to equip strategic bombers with them, to insure destruction of targets protected by a powerful system of anti-aircraft defense. Employment of such missiles, in the opinion of American military specialists, will lead in practice to a decrease of the vulnerability of the bombers themselves, since destruction of a target by a guided missile does not require the bombers' entrance into the zone defended by active means of anti-aircraft defense. On the other hand, guided missiles of the "air-to-surface" class, due to their small dimensions and high flight velocity, represent a target less vulnerable to anti-aircraft defense. One of the disadvantages of employing missiles of this class is, as was shown by tests, a decrease in the range of the bomber due to the external suspension and the great weight of the missile.

At present, strategic aviation in the USA is being armed with the GAM-63 "Rascal" guided winged missile of the "air-to-surface" class. From information in the American press, the maximum range of this missile and the maximum flight speed are reputed to be 240 km and 1800 km/hr, respectively. Carriers of the "Rascal" missile will be the B-47 and B-52 strategic bombers (Fig. 5).

The tests conducted have shown that two "Rascals" can be installed under the wing in an outside suspension system on each side of the fuselage. It is proposed that the new B-58 "Hustler" strategic bomber be equipped with these missiles also. The missiles are launched from the bomber at an altitude of 12-15 km and at a range of 140-160 km from the target. Under the propulsion of its own motor the missile reaches an altitude of 25-30 km and then dives at a shallow angle on the target. Guidance is initially effected from the carrier aircraft and later by an inertial system with astronavigational corrections.

American military specialists concede that the maximum range of the "Rascal" is insufficient to insure the safety of the carrier bomber. With the present depth of anti-aircraft defense, the carrier bomber proceeding to some target behind the enemy lines can run into fighter planes of the anti-aircraft defense prior to the launching of the missiles and under these conditions, will represent a rather vulnerable target.

The fact that military units, ships, and aircraft are armed with guided missiles of the "surface-to-surface" and "air-to-surface" class and the crash development of new, more advanced types of these weapons are proof of the fact that the military leaders of the USA are planning a very wide application of these for the purpose of aggression.

Lt. Col. B. V. Aleksandrov

TO OUR READERS

In the twelfth issue of the magazine the editors included a "Readers' Questionnaire" and requested readers to express their opinion on a number of points touching on the materials published in the magazine during 1957.

We have received many letters. Besides the answers to the Editors' questions, many readers have sent in various remarks and suggestions.

The Editorial Board thanks all the readers who have complied with its request and will endeavor to give consideration to all the remarks and proposals.

We await other letters and other proposals.

THE EDITORIAL BOARD OF "THE HERALD OF THE AIR FLEET"