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TRANSLATION

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HERALD OF THE AIR FLEET

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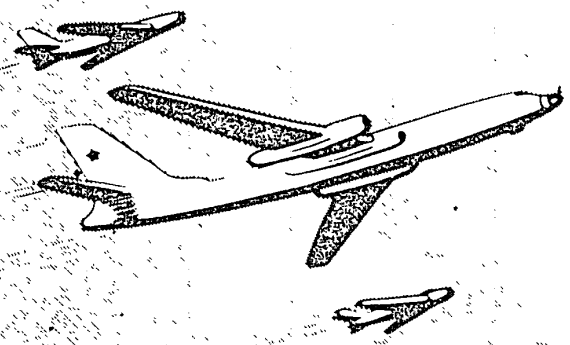

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1957

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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)

7

1957

STAT

SOVIET AVIATORS ARE BOUNDLESSLY DEVOTED TO THEIR PARTY

The Soviet State is nearing 40 years of age. For four decades, the first country in the world to have freed itself from the fetters of capitalism has been boldly proceeding along the unexplored path of constructing a Communist society, under the leadership of the wise party of the Communists headed by the Central Committee.

Our people constructed Socialism and defended it in a fierce struggle against the striking forces of international imperialism. Putting the program planned by the Communist Party into effect, it has converted the country into one of the most progressive, highly developed countries in the world. Our industry now produces something over 30 times more than it did in the prerevolutionary period.

All the nationalities of the Soviet Union are developing successfully in a friendly family of nations. During the years of Soviet power, each republic of the USSR has changed beyond recognition. Our country is an example of a moral and political unity of peoples, which is unprecedented in history.

For us to picture to ourselves the grandeur of the historical transformations in the Russian Federation, it is not out of place to call to mind how the great Lenin characterized the pitiful legacy we received from the tsarist autocracy: "Have a look at the map of the RSFSR. To the north of Vologda, to the south-east of Rostov-on-the-Don and Saratov, to the south of Orenburg and Omsk, and to the north of Tomsk, stretch boundless reaches, where there is room for scores of tremendous civilized states. But in all these reaches there reign primitive patriarchal conditions, half savagery, and savagery in the truest sense".

The Soviet People have put an end for all time to century-old backwardness. Now the regions that V. I. Lenin wrote about have been radically changed. The sage general party line, as laid down by Lenin and directed at the crash development of heavy industry, has been translated into reality, and, as a consequence, high rates of growth have been assured in the RSFSR for such decisive branches of industry as ferrous and non-ferrous metallurgy, the coal, oil, and chemical industries, power engineering, and machine construction. Industrial output in the RSFSR in 1956 was almost 31 times greater than in 1913.

A similar picture of a flourishing economy may be observed in all the other republics constituting a mighty industrial and kolkhoz power — the Soviet Union. The unprecedented development of economy, the flourishing of culture, science, and art, and the unity of the Soviet People in a single family of fraternal nations — all these are indisputable facts which bespeak the grandeur of the achievements of October, of the wise leadership of the Communist party.

The material well-being and cultural level of the Soviet People have risen immeasurably. National income has increased greatly. In ever-increasing volume, material goods have been placed at the disposal of our people for the satisfaction of their needs. The well-being of the Soviet people has been growing and will grow steadily

from year to year. The population has been receiving additional benefits amounting to over 35 billion rubles a year, merely as the result of measures put into effect last year (the raising of pensions, the increase in wages for lower-income laborers and employees, increase in fixed and purchase prices for agricultural products, etc.). A new manifestation of concern for the welfare of the people is seen in the publication on 5 July of a Decree of the Central Committee of the CPSU and of the Council of Ministers of the USSR "On the abolition of the compulsory deliveries of agricultural products to the State by the farms of kolkhoz workers, and of laborers and employees". Only in the country of the Soviets, where the working-man stands in the foreground, is such concern for the welfare of the people possible.

Guarding the great achievements of October and the defense of the freedom, independence, and happiness of the Soviet People, the Armed Forces of our state stand alert — a reliable shield and guarantee of the peace and security of the workers.

The Armed Forces of the Soviet Fatherland were created almost forty years ago, in accordance with the wise instructions of the great Lenin, for the defense of the Soviet State. In the very first months after October, V. I. Lenin proclaimed: "We have been defenders since 25 October 1917; we have won the right to defend our fatherland ...

"It is precisely because of the fact that we are advocates of the defense of the Fatherland that we say to ourselves: 'For defense we need a steadfast and vigorous army and a sturdy home front'."

All of the Soviet People including us — soldiers of the Soviet Air Force — are particularly glad to know that the Communist Party, headed by V. I. Lenin, the great leader of the Soviet People, stood by the cradle of our Air Force as a leading and guiding force. From the very first days after the Great October Socialist Revolution, by a decision of the Communist Party and upon instructions from V. I. Lenin, the Soviet People, creator of the new socialist state, started to form Air Force detachments within the framework of the Armed Forces, for the fight against the hordes of White Guards and interventionists.

The War Revolutionary Committees, the Bureau of Air Force Commissars, and the All-Russian Collegium for the Administration of the Air Fleet played an important role in the building of the Air Force. The Party was concerned with strengthening the cadres of the flying and technical personnel. The best men, tested in the fire of the Revolution, were posted to the Air Force.

During the course of the battles against our enemies, the Air Force detachments grew mature and stronger. The number of Communist flyers increased, and their awareness grew. It is characteristic that out of the 730 men in the flying personnel of our Air Force, 347 were already Communists by January 1921.

The best Air Force men, defenders of the young Republic, were entering the Communist Party. Like one of the heroes of the Civil War, Pilot and Group Commander I. U. Pavlov, they would declare, upon entering the ranks of the Party: "I feel closer to the Communists than to anyone else." And in numerous battles with the enemy the Red military pilots proved, by their high skill, courage, and heroism, that they were real sons of a liberated nation, loyal to the great banner of the Party of Marx and Lenin. The heroic deeds of Pilots I. U. Pavlov, Yu. A. Bratolyubov, A. V. Pankrat'yev, I. K. Mikhalyuk, B. N. Kudrin, and many others, are bright pages in the combat history of our Air Force.

In creating and strengthening the Air Force detachments, our Party and Government displayed untiring concern for the development of aviation science, and for the training of flying and technical cadres. In spite of the tremendous difficulties connected with the Civil War and the resulting devastation, V. I. Lenin, the great leader of the Soviet People, regarded the needs of the scientists, designers, and pilots with solicitude. In commemoration of the fiftieth anniversary of the scientific activity of Professor N. Ye. Zhukovskiy, V. I. Lenin signed the famous decree in which he praised highly the services of the founder of aviation science, calling him "the father of Russian aviation".

The years passed. The Socialist State was growing and was becoming stronger. Carrying out Lenin's designs, the workers of the country of socialism, under the leadership of the Communist Party, transformed the appearance of our Motherland in short periods of time.

During the years of the prewar five-year plans, new branches of industry sprang up and grew strong, including aircraft and engine construction. Tremendous work was performed in training qualified cadres of aircraft builders, designers, engineers, pilots, and navigators. Our Motherland became a mighty air power.

During the difficult years of the Great Patriotic War, Soviet pilots showed themselves to be worthy sons of the socialist Motherland, able and brave defenders of their people. In spite of the tremendous difficulties of an armed struggle against a powerful and technically well-equipped enemy, our pilots bravely repulsed the attacks of the foe and succeeded in achieving supremacy in the air.

Sparing neither pains nor resources, the Soviet People supplied combat equipment for front-line needs in ever-increasing volume and the flyers made use of it in a fitting manner and with great skill. They routed the much vaunted Hitlerite Air Force, securing freedom of operations for our ground troops and saving the population from the threat of bombings from the air.

During difficult periods of combat, the most mature Communist pilots went to carry out the most crucial missions. They proved with their lives their filial devotion to the Motherland, the Party, and the People. In taking off on dangerous missions, many young pilots would leave brief, but ever so eloquent, notes: "If I die, I request that I be considered a Communist".

The entire history of the Air Force is the history of the loyalty of Soviet aviators to their military duty and of their devotion to their nation and its heroic Communist Party.

During the post-war years, the Air Fleet obtained new, more highly perfected equipment — jet bombers and fighters fitted out with the most complex instruments and apparatus. Now aircraft can fly at supersonic speeds, high altitudes, and in the stratosphere, by day and night, and under adverse weather conditions.

Our units and outfits have developed a considerable number of skilled, resolute men who know their work well — pilots, navigators, radio-operator gunners, radar station operators, engineers, technicians, mechanics, and the men of the air-technical outfits. And this is quite natural; for the Communist Party and the Soviet Government have untiringly taught and continue to teach that it is impossible to solve problems connected with the securing of the defensive capacity of the Fatherland without men who possess high combat morale and know how to use their weapons and equipment.

As has been pointed out by the Minister of Defense of the USSR, Marshal of the Soviet Union, G. K. Zhukov, our Soviet military science holds that military equipment, even the most effective, cannot, in and of itself, decide the fate of a battle or an opera-

tion. The outcome of armed combat in future wars, as well, will be decided by men who master their combat equipment perfectly, believe in the justness of the war aims, are deeply devoted to their government and are always ready to defend the interests of their people.

In carrying out the decisions of the Party and the Government, our flyers have achieved great success in the political and military training of personnel. Their love and devotion to their Fatherland are thereby manifested concretely.

Now the entire Soviet People are working with fervor and creative enthusiasm at putting the historical decisons of the 20th Congress of the CPSU into effect. In the program worked out by this Congress, methods have been pointed out for solving developmental problems of Soviet society which have come to a head, and basic principles have been formulated on the most important questions of the international Communist movement.

And now at a time when the Communist Party, under the leadership of the Central Committee of the CPSU and relying on the support of the entire nation,has been conducting tremendous work in carrying out the decisions of the 20th Congress, the anti-Party group of Malenkov, Kaganovich, and Molotov rose in opposition to the Party line.

By anti-Party, factional methods, this group was trying to bring about a change in the personnel of the leading organs of the party, which were selected at the Plenum of the Central Committee of the CPSU, by setting themselves the goal of changing Party policy and by bringing the Party back to the wrong methods of leadership, which were condemned by the 20th Congress.

For the past 3 - 4 years the Party, resolutely correcting the errors and shortcomings engendered by the cult of personality, has been successfully fighting against the revisionists of Marxism and Leninism, both in the international arena as well as within the country. Important work has been carried out by the Party in correcting distortions of Leninist national policy which were committed in the past. The participants in the anti-Party group have constantly put up opposition,direct or indirect, to this course which was approved by the 20th Congress of the CPSU.

They opposed the execution of such very important Party measures as the broadening of the rights of the Union republics and the enhancing of the role of local Soviets. They were against the assimilation of virgin and fallow lands, and they kept objecting to a change in the planning procedure in agriculture and to the administrative reorganization of industry. They opposed a number of measures aimed at improving the welfare of the nation. In the field of international relations, the Malenkov-Kaganovich-Molotov faction attempted in effect to counteract the Leninist Party policy aimed at peaceful coexistence among states with different social systems, and to oppose a relaxation in international tension.

The Plenum of the Central Committee of the Communist Party of the Soviet Union, which was held from 22-29 June 1957, considered the question of the anti-Party faction of Malenkov, Kaganovich, and Molotov which had formed in the Presidium of the Central Committee of the CPSU.

In the Decree of the Plenum of the Central Committee of the CPSU "Concerning the anti-Party group of G. M. Malenkov, L. M. Kaganovich, and V. M. Molotov", it is stated: "The position of Comrades Malenkov, Kaganovich, and Molotov, which is at variance with the Party line, is based essentially on the fact that they have been and are the captives of old notions and methods; they have lost touch with the life of the Party

and the country; they do not see the new conditions or the new situation but display conservatism and cling stubbornly to antiquated forms and methods of work which do not correspond to the interests of the movement towards Communism; and they reject that which life has engendered and which flows from the interests of the development of Soviet society and the interests of the entire Socialist camp.

"Both in questions of domestic, as well as in questions of foreign policy, they are sectarians and dogmatists and display an uncritical and lifeless approach to Marxism and Leninism. They cannot grasp the fact that under modern conditions, living Marxism and Leninism in action as well as the struggle for Communism manifest themselves in the implementation of the decisions of the 20th Congress of the Party; in persistently conducting a policy of peaceful coexistence and of struggle for friendship among nations, a policy of strengthening the Socialist camp in every way; in improving industrial management; in struggling for a thorough upsurge in agriculture, for an abundance of produce, for large-scale housing construction, for broadening the rights of Union republics, for a flourishing of national cultures, and for every kind of development of the initiative of the popular masses."

The Presidium of the Central Committee and the Central Committee as a whole kept correcting Malenkov, Kaganovich, and Molotov patiently and fought against their errors, hoping that they would take a lesson from their errors and not persist in them, and that they would get in step with the entire leadership of the Party. But they continued to maintain their erroneous non-Leninist positions.

After convincing themselves of the fact that their erroneous speeches and actions were meeting with constant rebuff by the Presidium of the Central Committee which consistently puts the policy of the 20th Congress of the CPSU into effect, Molotov, Kaganovich, and Malenkov embarked upon a course of group struggle against the Party leadership.

However, the Central Committee of the CPSU, united and, like Lenin, high-principled, repulsed in good time the adventuristic activities of the anti-Party faction of schismatics who had lost touch with the Party and the people. Facts revealed at the Plenum of the Central Committee fully unmasked the anti-Party group, whose activity had been aimed at splitting the Party and changing its general policy. In embarking upon a course of factional struggle, Malenkov, Kaganovich, Molotov, and Shepilov, who had joined up with them, violated Party Rules and the decision of the 10th Congress of the Party, as worked out by Lenin, "On Party unity", in which the Congress demanded immediate disbandment of all factional groups and charged all organizations to see to it strictly that no factional speeches whatsoever be allowed. At the same time non-fulfillment of this decree entailed unconditional and immediate expulsion of the culprits from the Party.

The Plenum of the Central Committee unanimously condemned the anti-Party group. In the entire membership of the Plenum there was not a single man to support these schismatics.

The Plenum of the Central Committee of the CPSU expelled Malenkov, Kaganovich, and Molotov from membership in the Presidium of the Central Committee and membership in the Central Committee of the CPSU; it removed Shepilov from his post as secretary of the Central Committee of the CPSU and struck him from the list of candidates for membership in the Presidium of the Central Committee and from the membership in the Central Committee.

The men of the Soviet Air Force, together with our entire party and people, unanimously approve the Decree of the Plenum of the Central Committee of the CPSU, and angrily stigmatize the anti-Party activity of Malenkov, Kaganovich, Molotov, and Shepilov who joined up with them. The speeches of pilots, navigators, engineers, technicians, and all aviation specialists at meetings of Party aktivs, at Party meetings, and at general personnel meetings bespeak the indestructible solidarity of the aviators behind their Communist Party and its Leninist Central Committee.

"Our glorious Party and the entire people, united and indivisible, are proceeding confidently towards the planned goal: Communism", said Pilot First Class Lt. Col. A. F. Krasikov in a speech at a Party meeting of Unit X. "And now men have turned up who took it into their heads to split the Party. They connived behind the Central Committee's back. But the Central Committee disclosed and stigmatized this anti-Party group of schismatics in good time. And it could not have been otherwise; the unshakable unity of the Party's ranks is the source of all our victories. The course of our Party is correct and no one will ever succeed in deflecting us from it."

Military Pilot First Class, Communist I. A. Primov, warmly approving the decisions of the Plenum of the Central Committee of the CPSU and angrily condemning the schismatic activity of the anti-Party group, spoke of the fact that every Communist must raise his ideological level even higher and must be uncompromising towards any manifestations of laxity, ideological instability, and lack of discipline.

The words of Military Navigator First Class Lt. Col. Ye. G. Dagayev rang with emotion. "In the history of the Party", he said, "there have been many factional groups of all kinds who have tried to split the unity of the Party. And each time their schismatic, anti-Party activity was the result of their having lost touch with the masses. This gave rise to an attitude of lordliness, degeneration, arrogance, and contempt for the needs of the people. And that is true now as well. Only those who have divorced themselves from the people and lost touch with life could have fallen so low and, in effect, have played into the hands of the enemies of our Fatherland. But the Party will always find the strength to repulse degenerates and factionists. The Party has become even stronger as a result of its conclusive unmasking of the members of the anti-Party group. The decisions of the Plenum of the Central Committee of the CPSU are correct and timely."

In all groups and units of the Air Force, the personnel has been actively discussing the Decree of the Plenum of the Central Committee of the CPSU "Concerning the anti-Party group of G. M. Malenkov, L. M. Kaganovich, and V. M. Molotov". And everywhere the opinion of the soldier-aviators is unanimous: the June Plenum of the Central Committee of the CPSU has given a deserved rebuff to the factionists and honorably defended the monolithic unity of our Party, a unity which has developed and grown strong in uncompromising battle against the Party's enemies. The Plenum has once more clearly shown how unshakable are the ranks of our Leninist Party which has been trained in the spirit of devotion to the ideas of Communism, and in the spirit of indestructible unity of thought, will, and action.

Just like every man in the Armed Forces of the USSR, the Soviet aviators are proud of the fact that during the period which has passed since the 20th Congress of the CPSU, life has become better for the workers of our Fatherland, new and splendid victories have been won in industry and agriculture, the power and authority of the Communist Party have grown even greater, the Leninist unity of its ranks has been strengthened, and its leading role in Soviet society has been enhanced.

Our mighty Fatherland, directed and guided by the Communist Party is in a new upsurge. It has the power to handle any problems and it confidently continues to move forward towards Communism.

The Soviet Armed Forces and their component, the Air Force, stand guard vigilantly over the peaceful work of our people.

Our soldier-aviators are filled with the unbending aspiration to close their ranks even more tightly and, under the invincible banner of Marxism and Leninism, steadfastly strive for newer and newer successes in combat and political training and in the enhancing of vigilance and combat readiness in their units and outfits. Soviet aviators have been and always will be loyal to their people and boundlessly devoted to their Communist Party.

In the future as well, the personnel of the Air Force will untiringly scale the heights of flying proficiency; increase the ranks of outstanding men — first class air warriors; and make use in full measure and under any conditions of the combat equipment which has been entrusted to them.

The pilots and navigators, engineers, and technicians, experts in all aviation specialties will persistently continue to struggle to reinforce iron discipline and solidarity and to enhance their readiness to carry out all tasks assigned them by the Communist Party and the Soviet Government.

A GLORIOUS SEVENTY-FIFTH ANNIVERSARY

Seventy-five years have passed since the day when, in our country, the world's first aircraft was built and tested in the air.

It may seem that everything has been said about A. F. Mozhayskiy long before our time. It seems that critics representing all groups and trends have examined his work in detail, have been debating it for three quarters of a century. They have not only examined in detail the design of his aircraft and the engines, but they also looked into the most unlikely incidental details that involved individual minor components and the time required for their production, and adjusted their findings to fit their homespun theories and interpretations. At times they wanted to picture him as a failure, at others they saw in him a mysterious inventor whose work was done not in terms of set dates and deadlines, but in terms of whole periods. In addition to this, behind their every line there lurked some other vague connotation, something ambiguous. In this way both explicit and implicit contradiction arose.

But even then, at the end of the 19th century, many progressive Russians were familiar with the creative work of A. F. Mozhayskiy. In spite of the fact that his work was classified, both scientists and prominent engineers fervently defended his inventions and highly esteemed them.

Articles and speeches of scientists and specialists of that period fill a very special page in the history of the struggle for the construction of the world's first aircraft.

Before building the aircraft the Russian inventor had carried out many tests and experiments. In 1876 he built a large kite and twice went up into the air in it. The following year he constructed the well-known models of the aircraft. The kite flights and the experiments with the models made it possible for Alexandr Fedorovich to obtain more precise critical data for his aircraft project and to check these data. An experienced marine designer who had built several ships, he approached the solution of his problem in an amazingly systematic and logical manner based on both theory and experiments.

On 3 November 1881, he obtained a patent for his machine. By 1880 and by the first half of 1881 all parts of the flying machine had already been manufactured. On 20 June 1881 Mozhayskiy pointed out in his memorandum that he "...had only to assemble the machine and to carry out the final tests." (TsGVIA [Central Government Military Historical Archives] Stock 740 (1), inventory 1, file 698, sheet 40) But it was only in the summer of 1882 that the Russian inventor succeeded in building the aircraft and starting testing it at the military field in Krasnoye Selo, near Petersburg. This happened 75 years ago.

In recent years the American press has given much space to the materials which prove the Wright brothers' priority in the field of aircraft construction. The authors of such articles are usually not restricted as far as the size of the articles is concerned. Entire issues of some aviation magazines deal with the Wright brothers. In these articles the Wright brothers are often called "the only people in the world who discovered

the laws of flight and knew how to fly a plane".

Such an exaggerated representation of the Wright brothers' work evokes a feeling of annoyance and protest on the part of the progressive scientific public, since it misrepresents the essence of the matter.

In our country no one has denied the fact that in 1903 the Wright brothers built their aircraft and ascended in it into the air the same year. But we should stick to the truth, after all. And the truth is that the Wright brothers were not the first people to build an aircraft which became airborne with a man on board. It was A. F. Mozhayskiy, a Russian scientist, who was the first man to achieve this.

Thus the American magazine "Aviation Week" is quite vainly wasting its polemical ardor when it offers its readers another sensational item saying that the Wright brothers have been "rehabilitated" in the Soviet Union and that the Mozhayskiy priority has been given up.

"Aviation Week" has found a fan in Belgium. His name is Lucien X. He declares right out that he didn't have a chance to look into the matter, that he doesn't know Russian but has read the item in "Aviation Week" magazine; and now he doesn't believe (let's add here: without any reason for it) in Mozhayskiy's achievements. These absurd and malicious insinuations expressed by the bourgeois falsifiers were elicited by the biased and confused article by Ye. Burche and I. Mosolov which appeared in 1956 in the sixth issue of the magazine "Voprosy Istorii" [Questions of History]. This item was quite contrary to reliable and incontrovertible historical facts.

It's quite obvious that the attempts made by the bourgeois falsifiers of history who, by their provocative statements, try to sow doubts about the priority of our nation in the field of aircraft construction are doomed to fail.

The priority of the Russian people in creating an aircraft which rose into the air with a man on board was proven 75 years ago. At that time the Wright brothers probably were not even thinking about projects in the field of aviation; one of them was then only 11 years old, and the other 15.

Seen in this light, the unfounded claims made by "Aviation Week" and Lucien X look ridiculous and naive.

His contemporaries assumed that, in days to come, Mozhayskiy's name would loom above the valley of life like a magnificent mountain, but far removed from the present.

But a new era in the history of mankind dawned — the Great Socialist October Revolution — and A. F. Mozhayskiy's works were read by those masses who hadn't known about his exploits. It was only in the time of the Soviet regime that A. F. Mozhayskiy's documents were publicized as well as books about him. The new generation of grateful readers plunged into their reading with an interest never witnessed before. Their interest in the remarkable inventor was never greater than on the 130th anniversary of his birth which was widely observed in 1955 in our country.

It is well known that A. F. Mozhayskiy didn't construct his aircraft in a vacuum. His discovery was the logical culmination in the development of technological ideas both in our country and abroad.

There is also another matter of great importance. All basic parts of a monoplane were incorporated in A. F. Mozhayskiy's design: wings, power plant, fuselage, landing gear, and empennage. Up to this day not a single element has been eliminated from this scheme.

And, by the way, many latter-day aircraft designs have appeared and quickly vanished without even a trace. Mozhayskiy's aircraft scheme has served as a prototype for the modern airplane. It has had a long life full of honor, 75 years in all. It has kept evolving, has been enhanced, but basically the modern aircraft has its beginnings in this design.

Every element in this scheme of design has been constantly developed and perfected, has kept changing as far as appearance and materials are concerned, has kept acquiring additional devices and various apparatus. But their purpose and function have remained unchanged.

Let us consider wings or fuselage as an example. Has the purpose and function of these most important elements in the aircraft design really changed? Of course not. In developing A. F. Mozhayskiy's aircraft scheme, designers, both in our country and abroad, introduced many remarkable technological innovations fostering the rapid progress of aviation technology. In these 75 years the aircraft engine has been changed three times. The steam engine was replaced by the internal combustion engine which, in turn, was replaced by the jet engine.

Here figures are quite eloquent. The speed of the A. F. Mozhayskiy aircraft built in 1882 was approximately 40-45 kilometers per hour. According to newspaper information, modern fighters fly at a speed of more than 2000 kilometers per hour. That's what the past 75 years have given merely in this one respect: aircraft speed has increased 45 times.

Not only was the aircraft being developed and improved during these decades. Our entire aircraft industry leapt forward, especially under the Soviet regime.

In the 40 years that have passed since the establishment of the Soviet state, science, including aviation, has made unprecedented advance and, ever progressing, is constantly achieving new goals.

The following comparison is interesting. Before the Great October Socialist Revolution, Russian aviation had existed for 35 years, and the basic indices (speed, altitude, flight range) had increased 3 times. During 40 years of the Soviet regime, on the other hand, our aviation, according to the same indices, increased 10 times, and, according to the indices in some specific instances, dozens of times.

The progressive role of our people in the field of conquering the air evolved historically, and, under the favorable conditions of the Soviet social order and political regime, the skill of our people has found a splendid application in the creation of our powerful Air Force whose heroic exploits were crowned by combat glory.

The advantages of the Soviet social order and political regime made it possible for our people, through their selfless work, to transform our country into a great air power. A decisive part was played by the struggle for preferential development of heavy industry which was so wisely directed by the Communist party. Our country's working class kept working steadily in order to transform their Motherland into a mighty independent power and to make Soviet aviation strong and powerful.

Even during the difficult time of war, our aviation plants stepped up aircraft production, and, by the end of 1942, had increased their output over three times. During the last three years of the Great Patriotic War our country gave her Air Force approximately 40,000 aircraft a year.

In the years following the war, as a consequence of the work done by Soviet scientists and designers, aircraft production in the USSR reached a new high, never achieved

before. Literally with every new airplane some new improvements were introduced, technological concepts were enriched, and the status of our country as a great air power became more secure.

The jet passenger aircraft TU-104, designed and built under the supervision of the Lenin Prize Laureate A. N. Tupolev, has attracted wide attention both here and abroad. This aircraft is equipped with two powerful jet engines, has a cruising speed of 800 km per hour, and can take on board 50 passengers and their baggage. Recently a new modified TU-104 went up. It can carry 70 passengers, has a greater load capacity, is comfortable, and its production is inexpensive.

At the present time, a group of engineers under A. N. Tupolev's supervision is working on the construction of a larger jet passenger plane, the "Rossiya" which will make much longer range non-stop flights with 200 passengers, i. e., the equivalent seating capacity of 5-6 railroad coaches. The following will illustrate what significance this has. Let's assume that such aircraft fly regularly between Moscow and Vladivostok and that their flying time per month reaches 200 hrs. In this case, 20 complete trains, or about 200 coaches and 50 railroad engines, will be released.

Recently a group of engineers under O. K. Antonov has designed and built a turbo-prop passenger aircraft, the "Ukraina". It is designed to carry 84 passengers and has a cruising speed of 600 kilometers per hour. In the very near future a new passenger plane, the "Moskva" will go up; it is going to be equipped with turbo-prop engines constructed by S. V. Ryushin and will carry 75-100 passengers.

Air Force pilots, navigators, engineers and technicians, these tireless toilers, keep adding to the glory of our Air Force. Noble qualities of the Soviet patriot's moral make-up find expression in their exploits: loyalty to their country, readiness to sacrifice to her all their strength, devotion to the Communist Party. These very qualities made it possible for our pilots to score new achievements in the years following the war. Soviet pilots have mastered completely advanced airmanship on jet fighter planes; they have successfully mastered the operational technique of other jet combat aircraft and jet passenger planes.

Our air age has been in existence for 75 years. This is three-quarters of a century. Observing this glorious date, our people take rightful pride in the fact that the first page in the history of aviation — the beginning of its era — was written by A. F. Mozhayskiy, a Russian scientist and inventor.

A. F. Mozhayskiy's name has always been cherished by our people as well as by all progressive mankind. Scientist, creator of the first aircraft in the entire world, his country's patriot who passionately defended his country's honor and glory, he goes on living in every newly constructed aircraft. He keeps living in our memory as a man whose life is inseparable from the history of his native country, from the glory of our people.

TACTICS

SELECTING A TARGET-RUN HEADING FOR BOMBERS

Hero of the Soviet Union, Guards Lt. Col. N. I. Gapeyënok

With the perfection of detection and ground control radar equipment the effectiveness of antiaircraft defense systems has improved considerably. Nowadays the enemy is able to spot the threat of an air attack even before bombers approach the front line and their targets, and to make timely preparations for repelling the attack.

As a consequence, bombers can no longer successfully accomplish their assigned missions without taking a number of precautions aimed at reducing the effectiveness of PVO [antiaircraft defense systems] facilities — in particular of AA artillery.

One of the problems involves selecting an appropriate heading for the target run.

When selecting a heading two basic requirements must be met: a safe approach to the projected line of the bomb run in order to successfully destroy the target; and the establishment of conditions under which a minimum of PVO facilities will be employed in repelling the attack.

The first requirement may be rather easily met by using various radio and radar facilities, by selecting typical landmarks which can be viewed from the air, as well as by thoroughly studying the nature of the target, its configuration, dimensions, and visibility. The second requirement is much more difficult to fulfill. In this case it is necessary to have specific data on the PVO of the target.

Selecting the run heading to a target located deep in the enemy's defenses depends

on the number and deployment of AA artillery, the front-line contour, the distance between the latter and the target, and the sighting devices being employed.

Inasmuch as the enemy objectives are almost uniformly defended over a considerable sector of the front and since the AA artillery emplacements are set up at a distance of 3 km from the main line of resistance (while the AA automatic weapons are set up at a distance of 800 - 1000 m), it may be assumed that bombers approaching the front line at medium altitudes will be subjected to fire beginning at a range of 8 - 10 km.

Consequently, the intensity of AA artillery countermeasures against bombers striking at defended objectives may be characterized to a certain extent by the duration of time spent within the range of AA artillery fire.

The minimum flying time within the zone of AA artillery fire for a single bomber or element depends on the bomber's target-run angle relative to the front line, the distance of this objective from the main line of resistance, as well as on the flying speed and bank angle on the turns.

The amount of time the bomber spends within the AA artillery zone of fire prior to bomb release will be minimal, if it makes the target run at a 90° angle to the front line. In this case the most favorable conditions for sighting with an optical or radar sight and for destroying the target are afforded the crews. If the necessity arises of using the orbits of a circling system, their heading is selected in such a way that the bomber will be exposed to AA artillery fire for a minimum amount of time.

Let us assume that a strike is being carried out against targets 6 and 18 km from the main line of resistance with the aircraft flying at 700 km/hr. A single bomber or element usually approaches the target at an angle of 30°, 45°, 60°, and 90° relative to the front line, and withdraws from it along the shortest route in the direction of friendly troops — maintaining a 20° and 40° bank angle on the turn.

Graph plotting and calculations made for these situations indicate a definite dependence between the target-run angles and the bomber's duration of flight within the zone of fire of the AA artillery. Comparing the data obtained (Fig. 1), we can plainly see that, as the distance to target location increases in depth, the most advantageous angles for the run approximate a right angle. In this case an increase in the bank angle on turns while withdrawing from the target at constant speed is accompanied by a reduction in duration of exposure to AA artillery fire by 10 - 18%.

Thus, a reduction in duration of exposure to AA artillery fire for a single bomber or an element is achieved by approaching the defended objectives at angles of 45° - 60° to the front line; while the requirement of minimum exposure to AA artillery fire may be advantageously combined with the possibility of employing the orbits of a range system for certain destruction of the target under adverse weather conditions and at night.

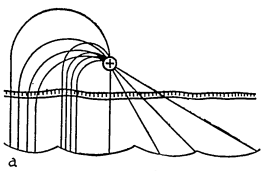
On the basis of these considerations, it is recommended that, during withdrawal from the target, the turn be made with the maximum possible bank angle, depending on the degree of crew proficiency in coping with operations under normal and complex weather conditions.

It is best for a bomber element to approach the target from the same direction. In this case a crew or an element will be subjected to the fire of only those AA guns which are located at a distance of 3 - 10 km from the path of the bomb run. When single aircraft approach the target from two or three directions considerably greater AA artillery fire power may be employed to counter their attack. A target-run approach from a single direction guarantees more thorough fighter cover for the bombers and a

more defensible combat formation for the element.

In the enemy's operational depth, AA artillery is employed for defending such objectives as airfields, ports, railroad and industrial objectives, etc. The number of AA installations employed depends on the importance of the objective, its configuration, dimensions, and its vulnerability to air attack.

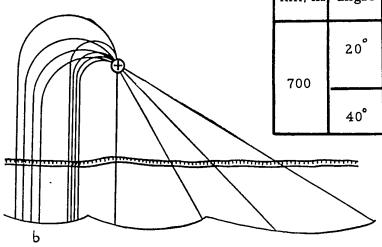
The batteries are usually emplaced around the objective at uniform intervals. Important approaches are reinforced with a number of additional batteries. Especially



a

Limits of AA fire zone

Speed km/hr	Bank angle	Approach angles 30°	45°	60°	90°
		Time under AA fire			
700	20°	5 min 17 sec	4 min 48 sec	4 min 28 sec	5 min 34 sec
	40°	4 min 42 sec	4 min 17 sec	3 min 46 sec	4 min



b

Limits of AA fire zone

Speed km/hr	Bank angle	Approach angles 30°	45°	60°	90°
		Time under AA fire			
700	20°	8 min 10 sec	7 min 6 sec	6 min 40 sec	7 min 38 sec
	40°	7 min	6 min 40 sec	6 min	6 min 52 sec

Fig. 1. Diagram of approach headings to target
a) Distance between target and main line of resistance - 6 km; b) Distance between target and main line of resistance - 18 km.

important objectives may be defended by "ground-to-air" type guided missiles. However, it is not always possible to defend the objective with equal density on all sides. Therefore, for approaching the objective it is necessary to select a heading which offers the least density of fire.

If the target is defended with equal AA artillery fire density, then it should be

approached in such a way as to minimize duration of exposure to effective fire.

In operational depth a target may be defended by AA artillery deployed over a considerable area. Therefore, it is better to select an approach to it from a single direction; then only that artillery will participate in countering the attack which is located at a distance from the flight axis of a single plane or of an element equal to the plane-of-fire zone for a given flight altitude. Thus, at medium altitudes, bombers will be exposed only to the fire of guns located 3 - 10 km from the flight axis. The remaining artillery defending the objective will be ineffective (Fig. 2).

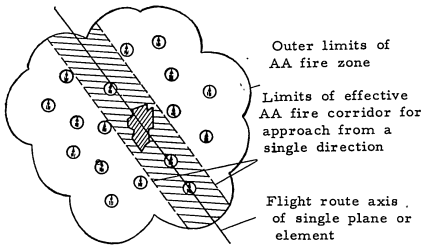


Fig. 2. Versions of target approach from a single direction; target being heavily defended by AA fire of guns deployed over a large area.

Simultaneous target approaches by an element from two or three directions precludes the possibility of concentrating fire on a single target, while simultaneous firing at several targets results in a considerable lowering of fire density.

An approach from different directions should be employed only when the attack's objective is defended by an inadequate number of AA guns or if the batteries which are covering the objective are deployed over a limited area and can fire at any point on the zone-of-fire limits.

If the objective is defended by AA guided missiles, then, in selecting the direction of approach, their deployment must be taken into account. When AA guided-missile sites are distributed around the objective it is desirable to select such a flight altitude at which the missiles' effectiveness is reduced. Thus, for example, it is a known fact that certain AA guided missiles have little effect when planes are flying below 5000 m. When the altitudes of operations are increased, other means of combat support must be employed — such as jamming the ground control facilities and the missile in flight, as well as bomber maneuvering.

In selecting the most advantageous approach heading to a mobile target, it is essential to secure the element of surprise in the approach; this will not only deprive the enemy of the opportunity to take timely and organized countermeasures, but will also deny him the time to disperse, to take cover, to employ camouflage, etc.

It is a well-known fact that with the present-day development of radar detection

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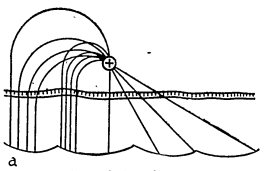

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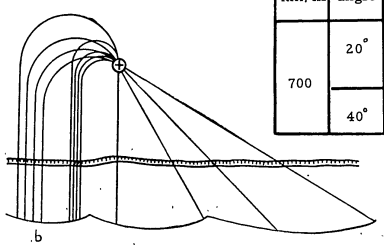

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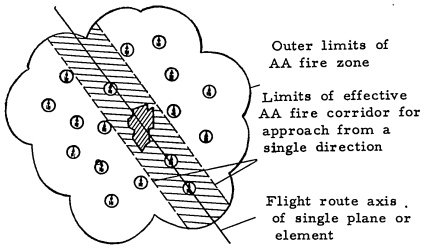

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It is a well-known fact that with the present-day development of radar detection

facilities, it is difficult to count on the element of surprise in approaching a target. Still, employing a suitable maneuver in connection with selecting the approach heading for attack will establish the conditions for overcoming more successfully the countermeasure effects of the AA artillery.

In this respect both the selection of the flight profile to the target and the maneuver employed in its vicinity may play an important role.

Let us assume that a bomber crew or bomber element is to make a strike against a specific target from an altitude of 4000 m. One of the possible flight-profile variants suitable for achieving the element of surprise in the operations will appear approximately as shown in Fig. 3.

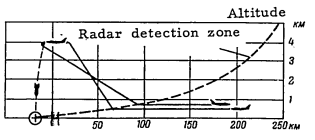


Fig. 3. One flight profile version for bombers.

The bombers fly on a route up to the radar stations' detection zone at a low altitude which insures flight safety. Sixty to seventy kilometers before entering the radar detection zone they pull up at the maximum possible rate of climb (so that, 1 - 2 min. before reaching the AA artillery fire zone or the initial point of the bomb run, they will have climbed to the planned altitude). Subsequently the crews execute an AA evasion maneuver and enter the bomb run. In this case, the bombers remain within the enemy's radar detection zone for 7 - 8 min. prior to bomb release. During this time the enemy will be able to vector only the fighters which are flying on patrol.

Repelling the attack will be considerably complicated if the target approach is made not directly from the route but from a turn. This will deprive the enemy of the possibility of determining in time the target-run direction and to assign batteries to the targets. The closer the initial point of the turn is to the zone of fire, the more difficult it is for the AA gunners to guess the strike plan and to distribute their own forces. Any change in the direction of the target-run — say one minute before entering the zone of fire — prevents a part of the artillery from participating in countering the attack.

Calculations show that, if the target run heading is changed approximately one minute before entering the zone of fire of the AA artillery which is defending the target, the probability of destroying the bombers is considerably reduced. This happens because the single plane or element by-passes the zone of effective fire of a given battery.

The selection of the target run heading ought to be combined with selecting the most advantageous flight altitude. But it must also be remembered that, as altitude increases, bombing accuracy deteriorates — particularly for small-scale targets; but at the same time the effectiveness of the AA artillery fire is lowered. Whereas in low-altitude operations the range at which the bombers are detected by the radar fire direction stations is reduced. The AA directors can obtain firing data only after the aircraft has traveled for some distance within the zone of effective fire. That means that during low-altitude approaches the radius of the zone-of-fire plane is reduced, and, consequently the aircraft's time of flight within the AA artillery zone of fire is shortened.

The bombers' target-run heading during operations against objectives which are

well defended by AA fire cannot be the same in all instances. In selecting it, the most advantageous altitude is taken into account. However, the chief and decisive factor in this is to accomplish the combat mission and to destroy the target effectively. When selecting the target-run heading, the nature of the target is considered, its dimensions, configuration, visibility from the air, etc. Thus, when inflicting a bomb strike against narrow elongated targets (railroad stations, bridges), effective results may be achieved only by making the run at slight angles to their long side.

Only an accurate knowledge of the tactical and technical capabilities of PVO facilities and of the sequence of their employment, a detailed study of objectives of operations and all the conditions of an air and ground situation will enable the flying personnel of bomber aircraft to execute successfully their assigned missions.

ON TARGET ON TIME

(During Air Force Training Exercises)

Lt. Col. F. A. Vazhin

The bomber pilots were assigned the mission of providing air support for a ground troops offensive. The defenders were offering stubborn resistance, and the combat operations were of an exceptionally mobile nature. The situation kept changing rapidly.

Sizing up the mission and evaluating the situation, Squadron Commander Maj. M. D. Bachilo strove to find the determining factor of the assigned mission and the special features involved in fulfilling it. First of all he noted that the crews would have to operate against targets located in the tactical depth of the "enemy's" defense, where there was a large number of various objectives (upon observation from the air, some of these were scarcely distinguishable from each other). Moreover, as reported by air reconnaissance, they were carefully camouflaged and their location was frequently changed.

Under these conditions, the commander came to the conclusion that coordination of bomber combat operations with the ground troops and, consequently, the success in fulfilling the combat training mission depended on approaching the target accurately with respect to time and place. The slightest error would not only decrease the effectiveness of the strike but would also jeopardize fulfillment of the mission.

He recalled an instance when the bombers, in solving a similar problem, had been late in approaching the target. The ground troops did not receive the expected support in time, and this hampered their operations. In a short period of time the situation on the battlefield changed. And when the crews reached the target, the necessity for the strike had already passed. They had to be quickly revectored to another objective. This complicated the maneuver and decreased the effectiveness of the aircraft operation. And what is more, the aircraft necessarily were exposed to enemy AA defenses for a longer period of time.

The importance of approaching the tactical target promptly was stressed also by the unit commander when he assigned the mission to the crews.

The squadron commander knew how difficult it is to maintain accuracy in striking at the correct time and place owing to the difficulty in spotting such objectives. In analyzing past experience in carrying out combat training missions he more than once became convinced that the target was found swiftly and hit accurately only by those crews which had studied thoroughly the terrain and the characteristic ground and radar checkpoints in the area of the combat operations. That is, in order to approach the target precisely one must be well acquainted with the terrain in the area of the forthcoming operations.

Further more, bombers provide support for an offensive by ground troops. Consequently, in order to spot the target, they must also familiarize themselves carefully with the situation both on the ground and in the air. Unfortunately we still have commanders who do not always give this sufficient thought. On the other hand, as has been confirmed by experience in the Great Patriotic War and in the postwar period, crews would find their bearings quickly in spotting a target and would approach it promptly if they were well acquainted with the tactical situation — the front line, the position of their own troops and that of the enemy, their operational tactics, and the situation in the air.

Both of these conclusions were confirmed by subsequent considerations as well. When there is a sudden change in the situation on the ground, the necessity may sometimes arise of revectoring the airborne crews. Only a well-trained crew that is familiar with the terrain and the situation both on the ground and in the air will be able to change the flight course, spot a new target, approach it promptly, and destroy it in a running attack.

The commander took into account the fact that promptness in approaching the target is to a large extent determined by the selection of the route and the target-run heading. True, when the route was selected during training exercises, the commander anticipated and took into account the fact that the bombs actually had to be dropped on a bombing range target. But in spite of that, with the situation that had shaped up on the ground and in the air being taken as a point of departure, the course was selected with consideration being given to the disposition of the fighter craft of the defending side, its radar facilities, AA artillery, and, finally, the nature and location of the target. In so doing, the senior commander tries to approximate the situation as closely as possible to that of real combat. The bombing range target which he chose was located on the last leg of the bombers' flight route towards the tactical target.

In organizing flights and the training for them, Major Bachilo and Squadron Navigator Captain B. G. Ryazanov decided to give special attention to such factors as planning the route and maintaining it while in the air, precision of takeoff, and operational sequence of the crews while in the air. And this was not accidental. Fulfillment of the mission begins essentially from the moment of taxiing out and takeoff. A delay in takeoff throws off the entire schedule, since the crew, in trying to make up for the lost time, will act hastily, and this will lead to undesirable consequences.

The bomber element commanded by Capt. V. A. Butikov was assigned a surprise combat training mission. A very limited amount of time remained for readying for the mission. The following question arose before the element command: How could the mission be organized so as to inflect a blow at the prescribed time? But since the flying personnel was familiar with the general situation both on the ground and in the air, getting ready for the sortie was made somewhat easier. Squadron Commander Maj. Bachilo acquainted the flying personnel with the changes in the situation both on the ground and in the air, pinpointed the flight course and the target-run heading, and briefed the personnel on the mission schedule. At this time he at once alerted the attention of the commander and the entire personnel of the element to the main factors deciding the success of the flight. This made it possible to organize preparation for the sortie more purposefully.

Immediately after the mission had been assigned, the technical personnel started to ready the aircraft. After familiarizing themselves with the situation, the flying personnel set about preparing maps. As they plotted the course they studied the terrain and planned the course of action in executing the mission.

A large work-load was laid upon the navigators, especially upon element navigator

Sen. Lt. G. I. Zubchenko. The flight course had to be computed accurately, and all the necessary data for air navigation and bombing had to be prepared. First of all the element navigator checked his watch and determined the exact time. That was a trifle, it would seem. But under conditions where the strike must be made precisely at the prescribed time, such a "trifle" is a very important factor.

Then he secured information about the wind from the weather station and also other weather data along the route and in the target area. This is particularly important for correctly computing takeoff time, the route, and the flight profile. Let us remark that more nearly exact data about the weather can be furnished, not only by the recon man, but also by the crews which participated in the preceding sortie in the given area of combat operations.

In organizing preparation for the sortie, important assistance was given the element commander by Maj. Bachilo and Capt. Ryazanov. The bombs were loaded in proper time, and the bombsight equipment and bomb armament of the aircraft were checked painstakingly. The squadron commander personally checked the readiness of the crews.

At the prescribed time, the crews took their places in the aircraft. The pilots reported to the element commander that they were ready. With the permission of the operations officer, the aircraft taxied out to the starting point and took off one after the other. Having become airborne on schedule, they were able to maintain the planned time in assembling and approaching the initial point of the flight route.

The element reached the first verified control point at the precise place and at the assigned altitude, but a few minutes earlier than the scheduled time, due to a change in the direction and force of the wind. The element commander and navigator had to decide swiftly and correctly how and when to use up the extra time. They appraised the tactical situation which had shaped up during the flight. After the first control point, the bombers were to reach a turning point and make a turn above it at an angle close to 90°. It was possible to use up the extra time by reducing speed. But the navigator at once calculated that they would not have time to do this before the turning point. Moreover, there was still another control leg ahead, where it was planned to adjust the autopilot and take a wind reading.

Consequently, the commander and the navigator decided to turn off to the left of the route and approach the turning point with a subsequent turn to the right onto the planned course. Such a simple maneuver made it possible to use up the extra time in a small segment of the flight route, to pass the control point at the prescribed moment, and to reach the NBP [initial point of bomb run] in proper time for dropping the bombs on the bombing range target. To some extent this maneuver also prevented the "enemy" from determining the bombers' true flight heading.

Before turning off, Zubchenko adjusted the autopilot and took a wind reading. Just as he had supposed, the data was different from that received on the ground before takeoff. In order to approach the target accurately, taking into account the change in wind, the navigator recomputed the remainder of the flight route and the bombing data. Before approaching the bomb run he determined the true flight altitude by means of the radio altimeter.

Thus all prerequisites were created for hitting the target accurately: the sighting data were computed according to the wind which had been read in flight at the altitude of bomb release, and the true altitude had been checked.

The crews dropped their bombs on the bombing range target as they broke away

Military Pilot First Class Capt. I. S. Likhosenko in unit X is one of the leading Air Force commanders who has successfully mastered the use of complex combat equipment. For his high achievements in training his subordinates as well as for his personal achievements in combat skill, officer Likhosenko has been awarded the Order of the Red Banner.

Photo: Yu. N. Skuratov

from the leader. Hitting the target depended on the compactness of the formation and the timeliness of bomb release by the crews in trail; the element commander had called the pilots' attention to this fact beforehand. Before approaching the bomb run, he reminded them once again of the necessity of maintaining their position in the formation and of flying low with respect to the leader, so that they could observe the instant of bomb release.

All that made a high degree of bombing accuracy possible in spite of the fact that target visibility was poor. A check of aerial photos carried out by Sen. Lt. Zubchenko confirmed the observations of the crews.

Before approaching the front line, the element commander established contact with the ground control officer who was with the troops. Previously Capt. Butikov had kept him informed about the flight and had obtained from him information about the situation on the ground. Now the tactical target and the time for hitting it had to be determined, since after the element's takeoff the situation on the battlefield might have changed.

The element navigator checked the remaining distance. It turned out that the bombers were proceeding one minute ahead of time. It was decided to reduce speed.

When they approached the front line, the ground control officer told them that the situation had changed and that the bomb strike had to be made on an objective located further to the left and several kilometers closer than the one in previous plans. This complicated the operations of the element commander and navigator. Only a few minutes remained before they were to approach the target; and during that time they had to change flight heading, spot the new target, and approach it precisely.

The navigator quickly found the target on a large-scale map and made the necessary computations. His good knowledge of the combat operational area and of the typical ground landmarks had a telling effect.

In order for them to approach the objective exactly on time, speed had to be reduced. The troops of "the defenders" were covered by strong fire from the AA facilities. To cut down its effectiveness, the element commander decided to resort to an AA evasion maneuver. In so doing, he was also acting on the basis of the tactical situation that had shaped up in order to approach the target precisely. The element had to turn off its previous course at an angle of about 20° and reduce speed. With this in view, an AA evasion maneuver was carried out.

The element navigator spotted the tactical target and rechecked the angle of drift. At the prescribed time the element made a running approach to the target and "dumped the bombs".

During the flight analysis the unit commander noted the successful fulfillment of the mission. The element had reached the objective at the precise place and time and had made its strike against it.

The success was determined above all by the fact that the squadron and element commanders, upon sizing up the situation, had correctly determined the nature of the mission and the special features for fulfilling it. It had been decided absolutely correctly that coordination of the operations of the bombers with the ground troops depends on the timeliness of approaching the prescribed target. In a given instance, the main thing was to make the strike at the precise place and time. It was on this basis that all the operations of the crews on the ground and in the air were organized; and this made it possible to concentrate the attention of the flying personnel on the basic factors

which decide the success of a flight, to train for the flight in a limited amount of time, and to carry it out efficiently. The element commander and navigator skillfully determined the methods for achieving precision in approaching the target. Starting from the takeoff and right up to the landing they operated in conformance with the situation.

However, not all commanders ascribe the necessary importance to an analysis of the situation on the ground and in the air. Thus, in one element, when the mission was assigned, the tactical target was not analyzed at all, but was regarded as a "practice target circle". As a result, the combat training assignment was carried out as an ordinary exercise. Consequently, preparation for the flight also took place in a routine fashion. In the air, the crews operated without initiative and did not react to a change in the situation in the air.

Of course the benefit derived from such a flight was insignificant. The tactical thinking of the flying personnel was not being developed, the necessary habits were not being inculcated. The element commander did not acquire the habits of leading his men in flight preparation and in the course of air operations. And he, after all, organizes the sortie and the fulfillment of the mission. A most complex situation may be met in the air, when bold operations, full of initiative, will be required of the commander.

Thus, for example, during training exercises, the element of Sen. Lt. A.G.Mikhaylenko took part in supporting a ground troop offensive. The target was to be bombed, use being made of an optical sight. After climbing to the planned altitude, the commander and the navigator noticed that, owing to haze in the air, the ground landmarks were poorly visible. What could they do? The situation on the battlefield was complicated and the terrain was unfamiliar. Improvement of visibility could be achieved by decreasing flight altitude. But that put the bombers into a position of tactical disadvantage. After sizing up the situation in the air and consulting with the navigator, Sen. Lt. Mikhaylenko rejected this method and made a bold decision — to climb to a higher altitude. Through experience he knew that visibility is sometimes improved that way. Moreover, a number of advantages were created, particularly the opportunity for carrying out an AA evasion maneuver. The commander's decision proved to be correct. Visibility improved at the higher altitude and the reserve of altitude was utilized for making the AA evasion maneuver.

After sizing up the situation correctly and making the tactically competent decision, Sen. Lt. Mikhaylenko carried out the mission precisely. At the same time the flight was instructive — both for the element commander and the flying personnel.

During Air Force training exercises, the flying personnel operates in a situation which has been maximally approximated to that of actual combat. Accordingly, it is with that situation in mind that the entire flight must be organized. A grave error is committed by those commanders who do not take that into account when analyzing and evaluating a flight. Sometimes, there are still instances when a flight is evaluated only by the results of the bombing. Of course, hitting the target is a basic factor in evaluating the performance of crews. However, under combat conditions it is impossible to achieve bomb-drop accuracy without the crews' taking the tactical situation into account.

It is clear that in a training flight not all the elements of the tactical situation may actively influence the crews and hamper them in carrying out their mission. But if the crews do not take into account all the factors of the situation both on the ground and in

the air which have shaped up during the flight they will become accustomed to operating under oversimplified conditions. That, of course, is inadequate for carrying out a combat mission. The enemy will offer strong resistance and will in every way possible impede reaching the target. And it is absolutely clear that pilots who have not trained themselves during peacetime to operate in a tactically competent manner in accordance with the emergent situation will find it difficult to count on success in actual combat.

THE COMMANDER AND THE PARTY ORGANIZATION

Lt. Gen. of the Air Force A. G. Rytov

Single command is one of the unshakable principles of troop administration. The commander in the Army, Air Force, and Navy bears full responsibility for the combat and mobilization readiness of the unit entrusted to him, for combat and political training, for the indoctrination and military discipline of personnel, for the fate and life of his men. The nation entrusts its most precious possession to commanders — human lives — and furnishes the Army with the newest combat equipment necessary for the armed defense of the Soviet State against imperialistic aggressors.

The very best men are trained and appointed commanders in the Armed Forces of the Soviet Union. In selecting its best sons and directing them to command work, the nation is convinced of their devotion to the Fatherland, of their readiness to defend the interests of the workers to the last drop of blood, and of their ability to organize the business of defending the peaceful labor of the peoples of the multinational Soviet Union.

High combat morale is characteristic of Soviet commanders. Ideological toughness and conviction as to the justice of the Party's cause, a firm will, persistance in carrying through to its conclusion a decision which has been reached, the capacity and ability to overcome the difficulties of combat life, a high degree of personal organization and discipline, and exemplary behavior in service and in family — those are the funda-

mental traits of our commanders. Our commander is exacting but tactful, strict but attentive, and just: he possesses a great deal of military knowledge, a high level of culture, and is constantly perfecting his skill.

Tasks of honor and responsibility for each soldier in the Army, Air Force, and Navy follow from the decisions of the 20th Party Congress: to strengthen the Armed Forces untiringly, and to guard in a reliable manner the peaceful toil of the Soviet People and the security of the Socialist Fatherland. Upon officers who hold single command positions, enjoy the deep confidence of their men, and possess important rights, lies the full weight of responsibility for the training and constant readiness of their units and elements. But single command by no means excludes — but rather it presupposes — consideration for the opinions of one's men and the implementation of their valuable suggestions in daily leadership, in the decisions and orders of the commander. Leadership of a military unit is unthinkable without reliance upon the Party Organization, without making use of its power and of its influence upon all aspects of the life of the unit for strengthening combat might and combat readiness. That is why commanders rely upon the Party Organizations in their daily work. The local Party Organization helps the commander actively in his important, complex, and crucial work.

On 27 April 1957 the Central Committee of the CPSU confirmed the "Instructions for Organizations of the CPSU in the Soviet Army and Navy", in which the tasks of the Party Organizations were clearly defined. "The Party Organizations", read the Instructions, "are obliged in their entire work to strengthen the combat might of the Soviet Army and Navy, to rally the personnel around the Communist Party and the Soviet Government, to indoctrinate the servicemen in the spirit of utter devotion to the Soviet Fatherland, in the spirit of friendship of the peoples of the USSR, and in the spirit of proletarian internationalism".

The principles of Party development in the Armed Forces of the USSR are defined in the Instructions, and the special features of that development are reflected there. The Party Organizations of the Armed Forces are an integral part of the Communist Party; they are guided in their entire activity — as are all organizations of our Party — by the Rules of the CPSU, by the Decrees of the Congresses and of the Central Committee of the Communist Party of the Soviet Union, and they base their practical work on the Instructions and the directives of the Ministry of Defense and of the Chief Political Administration.

Consequently, the local Party Organizations in the Army, Air Force, and Navy must steadfastly guide themselves by the Rules of the CPSU and the decisions of the Party, and, with that as a starting point, mobilize the men for carrying out the tasks of combat and political training, for strengthening military discipline, for mastering new equipment and weapons, and for supporting the constant combat readiness of the units and elements. Assuring the constantly growing readiness of personnel for the struggle to carry out problems confronting the unit actually means organizing the practical work of the Party Organization in mobilizing personnel to carry out the orders of the Ministry of Defense and of the commanders.

Leadership of the Party Organizations is exercised by the Political Agencies. That means that they are responsible for all aspects of the activity of the Party Organization. The Political Agencies have the right to form local Party Organizations, and with their consent Party Organizations are formed in the elements. The Political Agen-

Lenin Prize Laureate M. G. Surgutanov, Pilot of the Ural Geological Administration air party.

cies confirm secretaries and Party organizers, check on the activity of the Party Organizations, take stock of Party members and member-candidates, look after the qualitative and quantitative growth of Party ranks, the ideological toughness and moral purity of the Communists, etc. Thus, in the hands of the Political Agencies are concentrated all the most important functions which make it possible to exercise direct leadership over the Party Organizations.

Protecting the authority of the command cadres of the Armed Forces of the USSR, the Central Committee of the Party in the "Instructions for Organizations of the CPSU in the Soviet Army and Navy" defined the exact procedure for examining cases of infringement of Party rules by Communists. The right to decide the question of holding someone to account to the Party has been granted to the Political Agencies and the commanders. For example, cases of Party misdemeanors by Communists of the rank of sergeant, master sergeant, junior lieutenant, lieutenant, senior lieutenant, captain, and lieutenant-commander, are examined by the bureau of the local Party Organization with the approval of the deputy regimental or ship commander for political affairs and of the regimental or ship commander. The right to grant approval for a Party Commission in the political section of a large unit to examine cases of Party misdemeanors by Communists of the ranks of major, subcommander, lieutenant colonel, commander, has been granted to the chief of the political section, to the commander of a large unit, etc.

The commander directs the work of the Party Organization. That means that he personally and also through his political deputy exerts daily influence upon the Party Organization activity so that it, the Party Organization, struggles to carry out tasks confronting the unit and so that it rallies and mobilizes the entire personnel for the most successful solution of these tasks. The political deputy commander organizes Party work in the regiment and bears direct responsibility for its morale.

The commander exercises his guiding role by making use of the experience of the masses and by maintaining constant contact with Communists. Closely connected with the Party Organization, he presents it with problems, orients its members as to what they must give special attention to at one period of time or another, and where the main efforts of the Communists must be directed.

Uninterrupted contact with the Communists is the primary task of the commander, since the members of the Party Organization, located as they are among the personnel, know its needs and moods and will tell about them and, in other words, will help the commander take the necessary measures. The commander should understand that he and his men are in the same Party — a voluntary combat alliance of Communists holding the same views — and, as members of this party, they enjoy identical rights and bear responsibility before the Party for the cause of defense and for the morale of the unit.

The commander must be in communication with the Party Organization Bureau and with the secretary, must always know what the Communists are doing and give advice as to which questions must be given special attention in combat and political training, in indoctrination and military discipline of personnel. While speaking at Party Bureau conferences, and at Party meetings, he presents the Party Organization with regular tasks.

It is quite clear that without close personal contact with the Communists, the commander will not be able to utilize to the full the power and authority of the Party Organi-

zation to intensify combat readiness, the quality of training and indoctrination, and the strengthening of military discipline. Leading Air Force commanders are well aware of this.

Unit commander Lt. Col. B. V. Sutyrin, for example, regularly presents the Party Organization with concrete tasks, makes suggestions as to which way the chief efforts of the Communists and Komsomol members must be directed. He often chats with members of the Party Bureau, takes an interest in their work, gives advice on how to organize it better, and supports the initiative of the Communists and Komsomol members. The commander regularly appears also before the personnel with lectures and reports on political and military indoctrination. For the last two months alone he has given several reports on the combat-morale of Soviet pilots, on the role of officers in strengthening military discipline, on enhancing the combat readiness of the unit. Besides that, Lt. Col. Sutyrin often reports at Party and Komsomol meetings and attends conferences of the Party Bureau. Recently, on his initiative, the Party Bureau considered the question of "On the work of the Party Organization in the struggle against factors leading to flight accident". The report on this question was given by B. V. Sutyrin. The commanders and the Party Bureau secretaries of the elements were invited to the Bureau.

On flight training days, Sutyrin presents the Party and Komsomol Organizations with problems and advises them as to who must be given concrete assistance. In evaluating flights, he regularly sums up the Party-political support of the flying day. Officer Sutyrin is interested in all aspects of the life and activity of the regimental personnel. Thus, for example, with his active support and assistance, an evening meeting was held for officers on the topic, "For a healthy family and healthy living", which the officers and their families praise highly.

The Party Organization is the reliable support of the commander. The Party Bureau works actively, the Communists serve as models for the fulfillment of one's military duty and 75% of the Communists are Outstanding Men.

After succeeding in closely uniting the personnel of the unit and in setting up the training and indoctrination of the soldiers in an exemplary manner, the commander, with the help of the Party Organization, saw to it that the unit became the best in the group. The absolute majority of the pilots have first and second class ratings, and many have been awarded decorations and medals for mastery of flights under adverse conditions.

The Communists and the Komsomol Members of the unit were the initiators of socialist competition for giving a worthy welcome to the 40th anniversary of Great October. Right now the obligations which the men took upon themselves are being fulfilled. The commander and the Party Organization are skillfully directing the competition in which the entire personnel has been joined.

If we analyze the work of unit commander Sutyrin or of other Air Force commanders from the point of view of their leading role in the activity of the Party Organizations, we can observe that each one of them sets up this work in his own way, but necessarily in close contact with the aktiv of the Party and with the broad masses of the Communists. Let us take Air Force commander F. P. Onopriyenko as only one example. He is in constant contact with the secretaries of the Party and Komsomol Organizations and also with the members of the Party Bureau. F. P. Onopriyenko informs them in good time of the combat training problems to be solved next, and determines what, in his opinion, is required of the Party Organization and Communists for overcoming some defects or

other. A business-like contact with the Party aktiv helps the commander direct the Party Organization in good time towards a solution of the main problems confronting the unit.

The commander frequently attends Party Bureau conferences and Party meetings. Recently at a unit Party Bureau conference, there was a discussion on the question of the work of the Party Organization in training first class pilots. At this conference Onopriyenko listened attentively to the proposals of the Communists for eliminating shortcomings and then he himself spoke and told of the kind of help he was expecting from the Communists. And very soon thereafter the result of the work which they carried on was the awarding of the next higher rating to seven pilots.

Somewhat later, the Party Organization took up the question of improving the quality of work with Outstanding Men in combat and political training. A proposal was made: in qualifying Outstanding Men, soldiers and sergeants should be periodically rated in every outfit according to individual types of combat training. This proposal was approved by the commander, accepted, and put into effect.

Very often Onopriyenko chats with the Communists on the most varied topics in an informal atmosphere. In one such conversation he ascertained that the Party Organization was not exerting due influence on the young pilots. The Communists, as a rule, are already experienced pilots. But the youth are, on the whole, Komsomol members whom the Party members sometimes are apt to forget. The error was corrected in due time. Maintaining constant contact with his men and officers and with the Communists and Komsomol members, the commander daily directs the activity of the Party Organization. Active Party work in the unit has had a positive effect on the fulfillment of the combat and political training schedule and also on the strengthening of military discipline.

Every Air Force commander encounters the most varied problems which require an individual solution. Improving the quality of bomber training is one problem, strengthening military discipline another; and they must be solved in different ways. And this is precisely where the skill of the commander lies — to find the most expedient solution in each separate instance. To train and indoctrinate one's men in the right way means to know how to select, out of scores of possible variants, the most nearly correct, the most appropriate solution, under given conditions.

In one outfit the crews were somewhat behind in bomber training. The Air Force commander, I. P. Yalovoy, together with his assistants, analyzed the causes of such backwardness. And in order to plan the most expedient ways of eliminating the defects they had uncovered, he decided to consult with the Communists. A Party Bureau conference was called. The secretary of the Party Bureau, A. F. Arkhipov, invited the commanders and the leading navigator and engineer personnel. Valuable suggestions were made at the conference, and the commander succeeded in making use of them, putting them into effect with the help of the Party aktiv itself.

Another time, the commander ascertained that military discipline in one element did not meet present-day requirements. He suggested to political worker A. I. Lutsiy that he make a careful study of the state of training work. Many serious shortcomings were brought to light in the organization of political studies, and in the manner in which men spent their day off as well as the day preceding it. Upon the advice of the commander, the Party Bureau helped the Party Organization eliminate the shortcomings which had been observed. Together with the commander, A. I. Lutsiy conducted a meeting of

the outfit's personnel dealing with the results of a month's combat training and on the state of military discipline. Use was also made of such a form of indoctrination work as a talk by the commander who told (at an evening get-together to talk over old times) about the combat feats of his fellow officers during the years of the Great Patriotic War. The young soldiers listened very attentively to the account of the pilots' heroism, their exploits and their fearlessness. In reply to a question by the Komsomol members, Yalovoy told why he had received the distinction of Hero of the Soviet Union.

All this taken together was conducive to a noticeable improvement in the state of military discipline here. In a short time the outfit, which had previously lagged behind, assumed a leading position in the unit in combat and political training.

Officer Yalovoy's men recently took part in training exercises. The commander and the Party-political apparatus succeeded in drawing the wide Communist aktiv and the Komsomol members into the Party-political work, and this was one of the important factors that made for successful fulfillment of missions during the training exercises.

The Party-political workers and the Party aktiv studied problems involved in the Air Force exercises and the nature of flying. Officers Yalovoy and Lutsiy personally gave a thorough briefing to the commanders, the secretaries of the Party and Komsomol organizations, and the Party and Komsomol aktiv, on the nature of Party-political work among pilots, navigators, aircraft radio-operator gunners, technicians, and junior aviation specialists, all during the period of training and instruction.

Questions of assuring exemplary behavior by the Communists and Komsomol members in carrying out missions during Air Force training exercises were taken up at Party and Komsomol meetings and at conferences of the Party and Komsomol Bureaus.

Carrying out the decisions that had been made, the Party Bureau organized the work of propagandizing and inculcating the experience of leading Communists and Komsomol members — pilots, navigators, and specialists who service bomb armament for flights in an outstanding manner. On the initiative of the Party Bureau, Outstanding Bombardier, Capt. B. G. Ryazanov, spoke to the navigators and told how he had received high ratings for bombing with radar sights. The Bureau of the Komsomol Organization publicized among all small-arms technicians the experience of senior armaments mechanic Sergeant A. F. Zhurob, a participant in the All Army Conference of Outstanding Men.

Thanks to the efforts of the commander and the Party and Komsomol Organizations, the problems of the Air Force training exercises were solved with great success.

The unit commanders of the Armed Forces of the Soviet Union display deep Party spirit in their work, by taking care of the defense of the socialist Fatherland, daily intensification of the combat readiness and combat fitness of the units entrusted to them. They struggle persistently to carry out the orders and schedules of combat and political training, to indoctrinate and prepare Outstanding Men in training, and to take care of their men in a fatherly manner.

However, individual commanders sometimes allow in their outfits incomplete and inferior fulfillment of schedules for individual phases of combat training, over-simplification in instruction, a careless attitude to subordinates, coarseness and tactlessness. For example, officer A. G. Gudayev failed to notice violations of methodological sequence in training pilots and did not notice that in one outfit assignments were being given to the pilots which did not correspond to the level of their training. Of course, one can try to find various grounds to justify such a blunder. But such justification is not fitting for

a Communist who has been placed in a position of leadership.

In carrying out his tasks, the commander is always obliged to remember his responsibility to the Party and to the Soviet People for the work which has been entrusted to him. He must be exacting not only towards his men but also towards himself, and he must display a high Party spirit in all his work. But the Party spirit of the commander is tested and measured by his attitude towards carrying out the decisions of the Communist Party, by a feeling of deep responsibility towards fulfillment of his service duty.

The Central Committee of the CPSU requires more intense active participation and mettlesomeness in the work of the Party Organizations, and an intensification of Party influence in all aspects of troop life: "The Party Organizations are obliged to penetrate competently and actively into all aspects of combat training, military discipline, and personnel indoctrination" ("Instructions for Organizations of the CPSU in the Soviet Army and Navy"). This requirement can be carried out successfully, if the political agencies seriously intensify their guidance of the local Party Organizations, and if the commanders, personally and through their political deputies — who organize Party work in the regiment directly — guide the activity of the Communists towards the solution of the most important problems.

By making use of the method of criticism and self-criticism, tried and tested in the Party, the Party Organizations must acquire a deeper knowledge of combat training, strengthen military discipline, and improve personnel indoctrination. On the basis of criticism and self-criticism, they must skillfully uncover shortcomings in the training and indoctrination of the men and in Party-political work; they must help the commander take timely measures to eliminate shortcomings which hamper improvement of combat readiness in the units.

In carrying out the tasks fixed by the Rules of the CPSU, the local Party Organizations in the Armed Forces of the Soviet Union are obliged, as is stated in "Instructions for Organizations of the CPSU in the Soviet Army and Navy", to indoctrinate Communists in the spirit of the concepts of Marxism and Leninism, and in a spirit of intolerance to shortcomings, to strive to bring about their personal exemplary behavior in combat training and discipline, in observance of the military oath and in carrying out the requirements of military regulations and orders, and in every possible way to strengthen the principle of single command and the authority of commanders and chiefs.

Their primary duty is to indoctrinate in the Party members and Party candidates a high degree of political vigilance and constant readiness to defend the state interests of the Soviet Union, a responsibility for mastering and caring for combat equipment and weapons, a firm will and physical endurance, and the capacity to withstand steadfastly all the difficulties of field and combat life.

The obligation of the local Party Organizations consists of systematically carrying out the work of recruiting new members into the Party from the ranks of officers, first sergeants, sergeants, soldiers and sailors, and workers and employees who are conscientious, active, and devoted to the cause of Communism.

Guiding the Komsomol is the most important work of the Party. Consequently, the Central Committee of the CPSU obliges the Army Party Organizations constantly to guide the Komsomol Organizations, to see to the political and military indoctrination of the members of the VLKSM [Leninist Young Communist League of the Soviet Union] and to indoctrinate the Komsomol members and youth in a spirit of devotion to the Soviet

Pilots watching fighters in aerial combat.

Fatherland and the Communist Party.

A paramount task consists of strengthening ties with the broad masses of servicemen, of explaining to them the policy and decisions of the Party and the Government, of mobilizing the entire personnel for successful execution of the combat and political training schedules, of continuously perfecting their combat skill, and of striving to have every serviceman understand clearly that the strictest discipline is necessary in the Army and Navy.

Finally, the local Party Organization must always be familiar with the needs and moods of the personnel, must penetrate into all aspects of the life of a unit, help the commander and his political deputy solve problems of political and military indoctrination, and to popularize the experience of leading officers, sergeants, and soldiers.

These tasks and duties will be carried out successfully on the sole condition that the Political Agencies manage to guide the Party Organizations concretely and expediently, and that the commanders daily supervise their activity, maintaining close contact with the Communists, assigning timely and concrete tasks dealing with political and military indoctrination of personnel, the support of combat training, and the strengthening of military discipline. In organizing Party work, the political deputy must penetrate deeply into the practical activity of the Party Organization, and daily instruct the Party aktiv, together with the secretary of the Party Bureau, to organize the implementation of Party decisions.

Guiding themselves steadfastly by the requirements of the Central Committee of the CPSU as set forth in the Instructions, Air Force commanders and the Political Agencies will achieve an all-around improvement in active participation and mettlesomeness in the work of our Party Organizations, an intensification of Party influence in all aspects of the life and activity of the outfits and unit. And this, in turn, will serve to intensify further the combat readiness of the Soviet Air Force.

PARTY-POLITICAL WORK IN AVIATION TRAINING

Col. A. I. Tiguntsev

Aviation training represents a complex aspect of the combat preparation of every unit and outfit. During the entire training period the personnel is under tremendous physical and moral stress.

Success of the exercise depends on many factors: in the first place, on moral qualities, on well-rounded specialist training and physical hardening of pilots, navigators, engineers, and technicians — of the entire personnel of the air and engineering outfits.

During the strenuous days of the training, activities of the Party and Komsomol organizations usually become more intensive. All measures are taken in order to direct Party effort towards improving personnel preflight training and preflight servicing of equipment, towards raising the application standards of this equipment both on the ground and in the air, toward providing constantly for the material well-being of military personnel.

Party and Komsomol meetings are being held in the outfits. Ways to carry out missions assigned by the command are discussed at these meetings. Where it is impossible to organize a general meeting, sessions of Party and Komsomol bureaus, or conferences of Communists and Komsomol members are held. As a rule, commanding officers deliver lectures. Thus, for example, officer N. I. Korobchak delivered a lecture at the conference of Communists in unit X. In their speeches the Communists made definite suggestions for setting up flying personnel training and for servicing equipment.

They spoke about maintaining exemplary military discipline and efficiency. The secretary of the Party organization devoted his speech to pointing out ways of combatting over-simplification in training. He made an appeal to the Communists to spread more extensively information about their advanced experience. Special attention was given by the Party Organization to rendering definite aid to the command in preflight training of young pilots and navigators.

The Komsomol meeting whose agenda read "Carrying out to the letter a mission assigned by the command is the patriotic duty of every Komsomol member" went off in a businesslike way. Similar meetings and conferences mobilized Communists and Komsomol members for successful preflight training of the entire personnel. The gist of all suggestions could be primarily rendered as follows: the Party bureaus should actively assist commanding officers in familiarizing crew, flight, and squadron members, as well as staff workers and all aviation specialists with their definite tasks to the extent required from any specific category of military personnel.

Secretaries of the Party and Komsomol organizations as well as Party and Komsomol group organizers conducted important individual work. By their personal example and by their passionate appeal they mobilized both flight and technical personnel for carrying out excellently the standing orders. Since outstanding combat and political trainees were in the majority here, they were able to give practical assistance in crew

preflight training.

Upon receiving the training orders the technical personnel began to ready the aircraft equipment, whereas the flying personnel started to prepare maps, to study the flight course and profile, the flight conditions, and the conditions under which the assignment would be carried out. At the same time, training was being conducted in aircraft cabins and in trainers.

At that time the commanding officers explained to the crews the mission that lay ahead of them, bringing to their attention special points of training and planning for the first sortie, which looked complicated to the majority of the crews because it was to be carried out from an unfamiliar airfield on planes with maximum flying weight. The flight itself was to take place at high altitude and to follow a difficult and unfamiliar course. It was necessary to assist the crews in gaining full understanding of the factors involved in the takeoff, in familiarization with the course, and in making the proper calculations needed to approach the target precisely.

While assisting the commanding officers, the political workers actively participated in explaining the assigned missions, and, at the same time, enlisted for this work the cooperation of the best pilots, navigators, engineers, technicians, and other specialists — every one of them an expert in his field.

The Party activists conducted discussions with the crews concerning the elements of the flight missions and the duties which every crew member would have in organizing the integrated and precise work when airborne. They paid special attention to new crews who were participating in the exercise for the first time. The training standards of the personnel and the quality of the aircraft equipment, as well as the efficiency of aircraft and radar safety facilities were checked before the first night sortie; measures were taken to supply the aircraft rations on time.

One of the bomber outfits was assigned a responsible mission: energetic countermeasures against the "enemy's" radar facilities. Political workers and the Party organization helped the commanding officer to prepare the personnel for this task. The measures to be taken by the Party organization were discussed at a conference of the Party bureau. In accordance with the decision of the conference, discussions were conducted with the flying personnel and, separately, with the technical personnel. These discussions centered around the problems of readying equipment and of its proper use in the air.

To prevent and to eliminate in time any shortcomings which had been noticed, the Party organizations aided the command in analyzing all aspects of every sortie. The navigator of the bomber outfit, Capt. A. V. Pomytkin, for example, whose group had to attack the "enemy" airfield, didn't bring the element precisely onto the combat course; because of this the quality of the photobombing deteriorated. The commanding officers pointed out his mistake to Pomytkin. The Party organization conducted a discussion of the results of the sortie with Communists, and in succeeding sorties such mistakes were not repeated.

It is known that success is achieved through persistent effort, through intensive work to overcome difficulties, through an uncompromising attitude towards shortcomings, slackness and oversimplifications of all sorts. Commanding officers, political organizations, and Party and Komsomol organizations of the outfits which participated in the exercises did not turn away from difficulties, nor did they bypass shortcomings, nor put off the solution of important questions till they had more leisure and free time.

Political workers and the most active Party members mingled with the pilots and aviation specialists when the mission was being planned and when independent preflight work was under way. They helped the personnel in word and deed. At that time, individual discussions and direct on-the-spot assistance were the basic aspects of their work. Thus, Senior Lt. G. A. Kurdyukov, a crew navigator, fell behind his comrades in compiling the flight data. Capt. G. L. Dushkin, a political worker, came to his aid: he took the navigation rule and helped to calculate the flight time on all legs of the flight course; he told Kurdyukov which radar reference points could be expediently used to check the flight path, and compiled with him the flight plan. Dushkin gave advice to another navigator, namely, which civilian broadcasting stations and direction finders could best be used during the flight, and how he should proceed in case of the radar sight failure under conditions of a complete overcast.

Flights which would train the crews on an unknown airfield were planned for one night. The commander was absent, and his deputy was charged with supervising the flights; of course, it was much more difficult for him to organize the flights. In a brief period of time he had to complete a great deal of work in order to see that the assigned mission was carried out. Political workers rendered him the necessary assistance. Officer S. S. Bulychev, chief of the political organization, himself joined in the training and enlisted the cooperation of the entire Party political machine. The main difficulty consisted in the fact that no night flights had been previously conducted at the airfield, and therefore there were no lighting facilities on the landing strips and taxiways.

Communists assisted the command in mobilizing the personnel for high-quality preflight training. They also helped lay out the starting line in time, to set up guards at the airfield, to set up communications with the CKP [alert command post], etc. Komsomol members were enlisted to insure illumination of the taxiways.

In another case, the commander drew the special attention of the political workers to the training of the crews of the leading groups and the servicing of the planes that were to produce radio countermeasures and carry on retransmission of radio messages. Crews of these aircraft attended a separate meeting. The unit commander set forth a plan for work on special apparatus and requested that a painstaking preflight training exercise be conducted. Political Deputy Yu. M. Dubinov, as well as officers who were navigation specialists, worked directly within the crews so as to exercise control and to render assistance.

Navigator R. A. Mesyagutov, member of Capt. P. I. Axenov's crew, had only flown at night with an instructor, and was now going on a sortie independently for the first time. An experienced navigator, Maj. N. I. Fel'dsherov, member of the unit Party bureau, came to his aid. He informed him about some peculiar aspects of flying aircraft at night, of working in a dimly lit cabin, assisted him in drawing up a flight navigation plan and in making calculations. With such expert assistance, officer Mesyagutov carried out his flight mission excellently.

In their talks with the radio-operator gunners it became evident to the political workers that some of them had not mastered radio communication procedure. They reported this immediately to the commander. By his order, all co-pilots and radio-operator gunners went through additional training during which they learned correct radio communication rules, signal and code table procedure.

The following example illustrates the efficiency of the entire personnel. After

the bomber crews got set to taxi out for the takeoff, a higher H. Q. changed the assignment and shifted them to operations on more important objectives. Takeoff time was postponed by one hour. The time necessary to prepare new navigational computations and to work out courses was quite limited. Besides, all work was done at the airfield at night and in the rain, under the aircraft. Engineers and technicians secured lighting which helped the pilots to be ready for the sortie on time.

When providing the aircraft with oxygen much time is spent on attaching the truck hose to the aircraft. The driver, a Komsomol member, offered to help the aircraft mechanic, and thus considerable time was saved. Both Party and Komsomol organizations attached great significance to this fact; they discussed it in their talks with individuals and with groups, they reported about it in field papers and in radio broadcasts to the entire technical personnel and the drivers. Practical adaptation of this method greatly reduced the time needed for preflight servicing of the element's second sortie.

Numerous examples could be cited of well-integrated and precise work, as well as of mutual comradely assistance among the technical and flying personnel and the personnel of the outfits that were servicing the flights.

It would be unnecessary to try to prove that all this was the result of extensive work done by the commanding officers, political organizations, Party and Komsomol organizations in indoctrinating the personnel in the spirit of military comradeship and combat friendship, in indoctrinating every man with a deep sense of responsibility for carrying out the common mission.

Much attention was given to disseminating the work experience of topnotch pilots, navigators, radio-operator gunners, engineers, technicians, mechanics, and other aviation specialists. In doing this, the Party political workers aimed at making use of all the available ways and technical means in order to disseminate effectively and clearly the pioneering experience, better methods and techniques of work.

Military Pilot First Class S. I. Muskantsev carried out excellently his reconnaissance mission of an important target. With the commanding officer's permission, the Party bureau secretary organized a talk during which Muskantsev spoke to pilots of another outfit who were supposed to attack the same target. The officer specified in detail the nature of the objective, the means of approach, and the most noticeable checkpoints. He emphasized the necessity of exercising caution in the air and of distributing one's attention in such a way as to secure a safe flight. All this proved very informative and useful for the pilots taking part in carrying out the mission.

Fighter pilots successfully carried out their bomber intercept mission. Outstanding men made a report to the personnel. They told about the peculiarities of the attack. Pilots asked them many questions concerning the nature of the target approach maneuver, the bomber speed, the range at which fire had been opened, and so on. This helped them to prepare for future flights.

In the course of the exercise the gun camera was set incorrectly on one of the aircraft. This caused mutual bickerings between armament technicians and mechanics and specialists from the photo group. Political workers noticed this, and, together with the armament and the photo group specialists, they organized a review of gun camera loading instructions. Officers who made their observations informed the audience of the correct rules and demonstrated how the magazines are loaded and how the gun cameras are zeroed in. Specialists were reminded that the pilot's estimate in intercepting the target depended, to a great extent, on their work and on the results of their photography.

As a result, both the group air armament personnel and the photo service did a good job during the exercises.

The attempt to disclose the details — the "trifles" — in the work methods of top pilots, technicians, and other air specialists, and to let all personnel in any given specialty share in their experience, as well as a profound study of life, made it possible for the commanders, political workers and Party organizations to insure concrete and effective propaganda of advanced experience and to inculcate the work of the entire personnel with it.

Propaganda work on a mass scale was greatly enlarged in scope during the training; its aim was to clarify the training problems as well as to shed light on current domestic and international events.

V. I. Lenin said: "Clarity of propaganda and agitation is a basic condition. If our adversaries admitted and recognized that we accomplished miracles in developing agitation and propaganda, this should not be understood in its explicit meaning — that we had many agitators and much paper had been used. This should be understood in its implicit meaning: the truth that this agitation contained penetrated into all minds. And it is impossible to deviate from this truth."

It was this truthfulness, timeliness, and concreteness that permeated the entire agitprop work during the training. All propaganda and agitation workers tried to convince men by quoting facts and examples taken from life, and to correlate more closely the agitprop measures with the assignments that were being carried out, to render definite aid and to give proper advice to a pilot, a navigator, a technician, or any other aviation specialist.

On the very first day of the training exercises the fighter elements carried out successfully their assigned mission. The majority of the pilots proved to be mature and to possess combat training of a high standard. The senior commanding officer issued an order in which he expressed his gratitude and awarded citations to many pilots and technicians. Many soldiers and sergeants were awarded Air Force "Outstanding Man" medals for excellent maintenance of the aircraft equipment and for faithful discharge of their military duties. Gratitude was expressed to a large group of officers, sergeants, and soldiers. During the personnel assembly the political organization chief read the order and awarded the citations.

All the agitprop work was based on constant elucidation of the Communist Party and Soviet Government policies to the personnel, and on discussions of the domestic and international situation. Even on training days when tension prevailed, agitation workers and active Party and Komsomol members conducted discussions which had for their topic domestic and international political affairs.

Meetings with Great Patriotic War veterans promoted the education of the personnel in the spirit of responsibility, soldierly comradeship, and mutual assistance.

Lt. Colonels V. K. Lyalin and V. V. Sugrin, Heroes of the Soviet Union, made a personal appearance before the fighter pilots. They told in a convincing manner how important in combat are mutual assistance, good teamwork among the crews, and true military comradeship. They discussed in detail characteristic features of conducting air reconnaissance and spoke about their experience.

Letters to the relatives of the most outstanding men were one of the devices in the work of some units.

Daily newsreels and newscasts devoted to personnel activities during training

played an important part in acquainting as many as possible with the experience of Outstanding Men.

Agitation through visual means was effectively used for mobilizing the personnel during training. Well-executed posters, slogans, and appeals could be seen at aircraft parking spaces, at the starting line, at the personnel quarters, in messes — in one word, everywhere. Effectiveness and actuality were characteristic features of the visual agitation propaganda. It was always correlated to the problems of the day, always called for tackling some practical job. In the groups briefings were published which served as memos for the pilot, the navigator, the technician, and other aviation specialists. They contained the assignments for the day, formation plans, course profiles, etc. Here second copies of the plan tables were posted which gave the pilots and technicians a chance to obtain more exact specifications of their assignment, the time of the sortie, and to prepare properly for it.

In the course of the training exercise one of the crews completed in an excellent manner a flight with in-air refueling. A leaflet was devoted to this flight, and specially equipped exhibits depicted in detail all phases of the complicated mission.

In the free intervals between flights and during recreation hours cleverly planned mass cultural work was being conducted. Officer clubs of smaller and larger units as well as technical clubs among the outfits joined in this work. The personnel being dispersed, club cars, which managed to visit all the outfits during a day, were used.

The work of the clubs whose workers used to tape-record morning and evening newscasts is worth noticing. The news was later rebroadcast through a relay station set up in a car. The latest news was followed by a broadcast mentioning those whose performance was excellent on that day and propagandizing their experience. Newspapers and magazines were delivered to the airfield by car.

During the entire training period serious consideration was given to insuring adequate living conditions, especially to setting up food supply and organizing normal recreation for the personnel. Such consideration for living conditions on the part of the Party political workers was caused by the fact that the majority of the crews were operating from unfamiliar airfields during the training. As a consequence, serious difficulties arose in finding quarters for them.

Both political workers and medical service officers constantly checked standards in food preparation and food delivery time to the airfield. Refreshment stands were set up on all airfields.

Experience gained during the training indicates that a quickly changing situation and intensive work of the entire personnel do not allow the use of some of the conventional methods of Party-political work, since the mass of the personnel are removed for a long period of time from their immediate activities. However, the possibilities for Party-political work during the training are much broader than in the usual situation. This can be explained by the fact that all commanding officers, political workers, and the most active Party members remain with the personnel during the entire training period.

Direct contact of commanding officers and political workers with pilots and technicians, reports, brief group and individual talks, short conferences, information concerning the general situation and progress in carrying out the missions assigned to the units, popularization of and effective familiarization with advanced experience, short

meetings of the Party and Komsomol organizations within the squadrons, bureau conferences — this is only an incomplete list of the basic measures that can be applied during training. It is natural that best results will be achieved by those commanding officers, political agencies, Party and Komsomol organizations that apply similar methods while taking into account local conditions and adapt them to the problems to be solved.

COMPETITION FOR AN OUTSTANDING CREW, A TOPNOTCH ELEMENT

Military Pilot First Class Lt. Col. B. V. Sutyrin, Maj. B. S. Serikov

One of the squadrons in our unit was the first in the group to join in the competition dedicated to the 40th anniversary of the Great October Socialist Revolution. Under the leadership of Military Pilot First Class Maj. P. M. Gavrilov, the men of the squadron made socialist pledges and, through the Army press, appealed to all the flyers of the group to follow their example.

The men of the Air Force Bomber Squadron commanded by Maj. P. M. Gavrilov made definite pledges. They set themselves the goal of having in their squadron by the end of the training year 65% of the crews, 60% of the technical maintenance groups, and 100% of the detachments rated as Outstanding.

The element pledged itself to have the following by the end of the training year: 40% of the navigators, and 60% of the radio-operator gunners to be First Class.

For the purpose of achieving interchangeability in the technical crews and in the technical maintenance groups, a drive was launched with the aim of seeing that no less than 30% of the aviation specialists master a related specialty.

In an attempt to attain further progress in mass sports work, the squadron personnel pledged itself to pass the standard tests for the first degree GTO [Ready for Labor and Defense] badge, to train 50% as second degree GTO badge wearers, and 20% as rated sportsmen.

All these pledges are being successfully fulfilled. New Outstanding crews have already been trained in the squadron. The ranks of First Class military pilots and navigators have been increased. The maintenance group led by Technical Lt. A. A. Popkov and the detachment of Sgt. P. F. Presich have become Outstanding. Since the time the pledges were made, the number of rated radio-operator gunners in the squadron has increased five times over.

Why have we taken up this discussion about Maj. Gavrilov's squadron? Is it not in a better condition as compared with others and is not that fact the reason for its success in fulfilling the pledges made by the men? In reply to this question we must state flatly that other outfits of ours are in no way inferior to Officer Gavrilov's squadron. There are many experienced First Class pilots and navigators in the unit. Maj. Gavrilov's squadron will have to exert even greater effort, inasmuch as there are many young crews in it. But the men of this element have a tremendous desire to achieve the best results in training. It is precisely for that reason that they were the initiators of the competition in honor of the 40th anniversary of Great October.

We wish to tell about the manner in which socialist competition was organized in Maj. Gavrilov's squadron, and in other squadrons as well, and of what difficulties were experienced thereby and how they were overcome. We feel that this will be useful for Air Force commanders.

When the men of the unit, moved by the patriotic feeling of giving a worthy welcome to this significant date in the history of our Fatherland, began to manifest active zeal in competition, a legitimate question occurred to the Command and to the Party Organization: What must be done in order to avoid bureaucratizing this great and important work? There was a danger that individual men might overlook the main point or start making pledges beyond their capacity, or else compete in an area coming directly under prescribed service duties — and then the whole idea would turn into empty formality.

At once a new question cropped up: What is to be the nature of the mens' pledges? And it was decided that they must be definite so that their fulfillment could be more readily checked; feasible, so that formality could be precluded; and expedient, so that the specific nature of the competition under Army conditions could be taken into account in advance. It was with such considerations that we set about our work.

It would be wrong to think that the organization of the competition among the men of the unit and among the individual outfits went off smoothly without any complications. As indeed in any great undertaking, it was often necessary to select the most expedient forms, and, in each definite case, to find the solution which conformed to the overall plan. At times the men had to be assisted in determining their place in the group drive to achieve the best results in combat and political training.

Each commander had a talk with his men, and helped them outline feasible pledges which followed from the tasks facing the element and the unit as a whole. At the same time conferences were held in the unit by the squadron and element commanders and by the maintenance group chiefs, during which our potentialities in socialist competition were defined, and preliminary points for future pledges were outlined. The Party and Komsomol Organizations discussed practical problems in the development of socialist competition and in the securing of exemplary behavior by Communists and Komsomol members in combat training. Only after this preliminary work were the pledges of individual men and elements given publicity at meetings of the personnel where they were taken up in detail and where they received legal formulation.

In conducting individual work with the men, the commanders discovered a tremendous aspiration on the part of the men and the officers to enhance the quality of their combat training and of their personal combat skill. As a rule, their pledges were definite and corresponded fully to the general problems which were being worked on by the element, squadron, and unit. For example Crew Navigator Senior Lt. V. P. Gordiyenko pledged himself to become a Second Class navigator by the end of the training year, and Pilot Senior Lt. A. S. Sevast'yanov to attain the level of First Class pilot. In addition, as a crew commander, the latter decided to make his entire crew Outstanding by 7 November 1957. It is characteristic that Navigator Gordiyenko and Pilot Sevast'yanov serve in the same squadron which initiated the competition, and that it was they, in turn, who initiated the competition in the squadron.

However not all the pledges of the men were particularly specific in their original form. Some soldiers and even individual officers reduced all their plans to a general aspiration to study well. It was necessary to have special talks with such a category of servicemen, in order to examine what level they had achieved in personal training and what specifically they could do during the current training year. The Communists gave the commander important assistance in this work. Since they were well acquainted with the personnel of their element, with the level of combat training, and with the individual capacities of each man, they assisted the men and officers in making their

pledges specific. A very great deal for the development of competition in the unit was done by Communist B. M. Persiyanov-Dubrov. Since he was chairman of the sports committee, he skillfully organized mass sports work among the men. It was under his leadership that the barracks, unit headquarters, and the area of the military camp obtained all necessary equipment. Thanks to Persiyanov-Dubrov's great creative initiative, we were given the opportunity to join the competition for the best barracks and we feel that we will not take last place in that competition.

The individual work which was carried on contributed to the fact that there were almost no instances among us when pledges which had been made involved problems not subject to competition (for better execution of the commander's orders, for performance of guard duty, and for observation of military discipline). There were such attempts, but we managed to eliminate them in time. For example, a proposal was made that a pledge be taken for flying personnel to economize on fuel. Can such an item be included in a socialist pledge? We decided that such an item is not practicable. After all, an aircraft is not an automobile, and no matter how hard the pilot might try to consume less fuel during flight, it does not always depend on his will and desire. It is another matter again to be careful of fuel while refuelling an aircraft, and not to waste it while on the ground. The attention of the engineers, technicians, and junior aviation specialists was called to these matters.

A very great deal that was useful and interesting was provided by the discussion of socialist pledges at general meetings of the personnel. Proposals were frequently made here which solved important problems connected with enhancing the quality of piloting technique, bomber training, and air navigation in brief periods of time. For example, we have been seriously disturbed recently by the backwardness of some navigators in the field of bombing. They had an Outstanding rating in the fall, but in the spring they started to receive grades of three and even two. At the same time, the pilots were flying their aircraft in an outstanding manner under any weather conditions, even at night. How can there be competition here for Outstanding crews, when the navigators may let everyone down?. And are they the ones who are to blame here? What must be done for the navigator's training to be in line with the level of the pilot's training?

During the course of a lively exchange of opinions, we succeeded in uncovering the cause of the navigators' lag and in outlining specific measures for the training of Outstanding crews and even of Outstanding elements. Last winter almost the entire flight work was conducted under adverse weather conditions. This favored the improvement of the pilots' habits but hampered the training of the navigators. In the crews a gap resulted between the training of the pilots and that of the navigators, and this was manifested in a deterioration in the quality of bomber training. We now have every opportunity to eliminate such a shortcoming. This was given thorough consideration in the navigators' pledges, and we already have tangible results of the correct organization of competition for enhancing the quality of bomber training. The number of Outstanding crews has grown considerably and there are already two Outstanding elements.

There was a lively discussion of Socialist pledges in the TECh [Technical Electrical Unit]. Here, just as among the flying personnel, many specific suggestions were introduced aimed at improving the servicing of Air Force equipment. The TECh officers calculated that if they repair Air Force equipment and carry out regulation inspection jobs at the same pace as before, then, in view of the increased flying time for

each aircraft, even a year and a half would not be sufficient for them to fulfill the outlined plan. How then could they find a way out of the existing situation? One way of solving the problem was to speed up the accomplishment of the regulation inspection jobs; but for this purpose, the men had to learn to work swiftly and, above all, well. And it was precisely in this respect that competition was of assistance. The technicians and mechanics made specific pledges to learn to carry out various jobs on an aircraft more swiftly and in an outstanding manner. Good equipment of the work areas will certainly help the TECh workers find the lacking time for the job. They included the following point in their socialist pledge: to equip the laboratories of the groups in such a way that they could carry out all the jobs through their own efforts and resources. True, this point had to be made more specific later on: not "all" but "most jobs" (after all, with the best of intentions, it is sometimes impossible to do without plant laboratories), But, however that may be, the acceptance of such a point will undoubtedly be very useful. The speed-up of regulation inspection and repair jobs will also be furthered by the fostering of proposals for efficiency and by a drive for the careful handling of tools. These points of the TECh men's pledges are fully in keeping with the problems facing the technical personnel in socialist competition.

The men introduced a large number of other useful proposals as well during the course of considering the projected pledges. Each of those proposals is the fruit of important work, the result of the creative, patriotic enthusiam by which our officers and men now live.

Already during the course of discussing the formulation of the pledges, we fell to thinking how to give more publicity to the progress of the competition among the men. After all, the results of socialist competition are always higher in units where the men are kept systematically informed of how pledges in the neighboring crew, squadron, and adjacent technical maintenance group are being carried out. The proposal was made to put out special bulletins devoted to the work of the topnotch men. The proposal was accepted. It was decided to fit out special stands "To greet the 40th Anniversary of the Great October Socialist Revolution". Right now weekly newspapers are appearing in the elements which publicize the progress of the competition, and combat leaflets have become meatier. Notices are printed regularly under the heading of "Tribune of Advanced Experience". The Komsomol members proposed setting up a pennant labelled "The Best Crew". It seems to us this proposal deserves attention. We would like to pause to give further details about some forms for propagandizing the experience of top men in the competition.

Take pilot Senior Lt. Sevast'yanov, for example. At the beginning of the article we spoke of the fact that he was one of the initiators of the competition in Maj. Gavrilov's squadron. He has been successfully fulfilling his pledges. A special bulletin was put out devoted to Sevast'yanov. It began as follows: "The best pilot in our squadron is Senior Lt. Sevast'yanov." Further on, it was reported that it had not been easy for the officer to attain this honor. Only intensive work, a realistic approach to business, and effort had brought him to success in flight work. Sevast'yanov has mastered perfectly the skill of flying in the daytime during prescribed weather minimum; he has flown at night in the clouds and has mastered instrument landing. Specific figures of his flying time are cited, as well as the number of his landings in prescribed weather minimum in the day time and at night, with good and outstanding ratings. The bulletin also spoke of the fact that Senior Lt. Sevast'yanov has been successfully fulfilling the pledges he

made in honor of the 40th anniversary of Great October. The bulletin called upon the other pilots to fly as well as Senior Lt. Sevast'yanov flies.

In other bulletins as well, detailed accounts are given of the best men who have achieved high results in the competition for an Outstanding crew, for a topnotch element, and for the best technical maintenance group. And at the "Tribune of Advanced Experience" stand the participants in the competition themselves are given the opportunity to speak. In a brief notice entitled "Flying in Formation at Night", Senior Lt. Nekrasov tells of his experience in night flying tersely but without omitting anything important. In some notices the pilots and navigators write not only about the successes they have achieved but also of how they procceeded towards the heights of combat skill, what difficulties they encountered, and how they overcame them. In this respect there is an interesting article by pilot Senior Lt. V.D. Popugalov, entitled "How I Learned to Fly as an Element Leader".

The pilot frankly admits that formerly it had seemed to him to be considerably easier to be an element leader than a wingman because he had not flown as a leader previously. From the very beginning of flying in formation he had operated just as he had when flying alone. "That was my first error", writes the pilot. Popugalov does not conceal the fact that if poorly trained crews had been in trail, he would hardly have succeeded in assembling the element. He tells about his second error also. He kept executing all corrective turns by using the autopilot's coordinate turn knob; but, as is well known, these are sharper than when executed by manual control. Additional difficulties were created for the aircraft in trail in maintaining their position in the formation.

"During the second leg of the flight", writes Popugalov later on, "the navigator ascertained the time for reaching the target and reported that we were late. Consequently I have to increase flight speed. And so I do. I notify those in trail, increase engine rpm, and continue the flight at increased speed. Somewhat later I look around. There are no aircraft in trail. What then had happened? We were flying at an altitude of 8000 m. At such an altitude, speed has to be increased gradually when flying formation. But I had given the engine full throttle and the pilots in trail had not managed to react to my command swiftly."

There is an example of how many difficulties and failures a pilot must experience and overcome before he obtains the right to be called an Outstanding pilot. Frank conversations concerning difficulties and errors once again compel our men to recall that the path to the heights of combat skill is very complicated. But the more boldly, the more confidently, and the more persistently one proceeds along this path, the more swiftly will one become First Class pilot and gain victory in socialist competition.

All these and other measures for propagandizing advanced experience are conducted by the Party Organization, directed by the commander. At Party meetings and Bureau conferences, the Communists regularly discuss how pledges are being fulfilled and what measures must be taken in order to make the competition even more effective. And the Komsomol does not lag behind the Party Organization. But the work forms of the Komsomol Organization are somewhat different. For example, at Party meetings, we always begin discussing the progress of the competition with an analysis of the state of affairs. But the Komsomol members act differently. They hear each of their members tell how he has been fulfilling the Socialist pledges he made. At some Komsomol meetings no report was even made. The Komsomol members themselves were both reporting as well as speaking. We feel that such a form of accountability by youth for

their pledges is completely acceptable. Recently the Komsomol members thought of the idea of publishing a satirical leaflet, castigating slackers and boasters. Why not? That shows praiseworthy initiative.

Right now, of course, it is still too early to judge what results each of our men will achieve in the Socialist competition. However, its progress cannot but gladden our men and officers. The pledges made compel our pilots and navigators and all our specialists to brace themselves in their personal training and at the same time to improve the general state of affairs in the outfits and in the unit as a whole. All this is felt appreciably by each of us. Let us take just one recent flying day as an example. It can be called an exceptional one: all our young pilots made a night sortie as elements. That gave them the right to participate in Air Force training exercises.

Initial experience has already shown that Socialist competition is a really important device in the hands of the commander, the Party-political apparatus, and the Party and Komsomol Organizations, by means of which they can achieve maximum results in working with personnel.

USE OF ASTROCOMPASSES FOR NIGHT AND DAY FLYING

Docent, Candidate of Technical Sciences, Lt. Col. N. S. Sorokovik

The astronomical course-indicating instrument, or the astrocompass, allows one to compute and maintain the true course of an aircraft by taking the bearing to a celestial body. In the available astrocompasses, by taking the bearing to a celestial body, we measure its course angle (KU) and thus obtain the true course of the aircraft (IK) as the difference between the azimuth of the celestial body (A) and its course angle KU (Fig. 1):

Characteristics of Astrocompasses

$$IK = A - KU. \quad (1)$$

The azimuth of the celestial body in modern astrocompasses is computed automatically. However, for this purpose, we must first introduce into the instrument the coordinates of the aircraft position φ and λ and of the geographical position of the body; these, as is well known, are equal to the declination δ and the Greenwich hour angle t_{gr}. The azimuth of the body is a complex function of these coordinates and is determined by the formula:

$$\cot A = \sin \varphi \cdot \cot (t_{gr} + \lambda) - \cos \varphi \cdot \tan \delta \cdot \operatorname{cosec} (t_{gr} + \lambda) \quad (2)$$

Consequently, modern astronomical course-indicating instruments are rather complex and require knowledge for their competent use in flight. The problem becomes still further complicated by the fact that, due to the diurnal motion of the earth, the geographical position of the body on the earth's surface shifts, while, due to the movement of the aircraft, its positional coordinates shift. Consequently, the body's azimuth continuously alters.

According to the principle of design, astronomical course-indicating devices are divided into two groups: equatorial (AK - 53 p and DAK - B) and horizontal (DAK - I and DAK - DB). In the equatorial instruments, the direction-finding plane of the sighting system, at the moment of its alignment

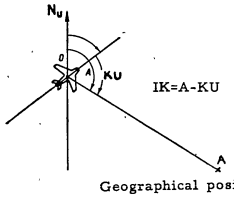


Fig. 1. Determining the true course as the difference between the body's azimuth and its course angle.

with the direction to the body, always coincides with the body's declination circle. This means that a declination setting is unnecessary in these instruments. In addition, the mechanism in these instruments which compensates for the earth's rotation is very simple. It consists of a clock mechanism which uniformly turns the sighting system of the instrument around the earth's axis. The equatorial instrument in itself is an azimuth computer made in the form of a three-dimensional simulator of the celestial sphere (spherant) which is quite conspicuous on the AK-53 p instrument.

In horizontal instruments, in contrast to the equatorial, the direction-finding plane of the sighting system is always vertical and at the moment of its alignment with the direction to the body, it coincides with its vertical circle. There is a special computer for calculating the body's azimuth and for solving the problem IK=A-KU. A clock mechanism is used to compensate for the earth's rotation. However, this mechanism is connected to the computer which converts the hour angle increment into an azimuth increment.

The theoretical principles of astronomical course-indicating instruments were very definitively developed in 1949 by L. P. Sergeyev. On the basis of this theory, many problems not only pertaining to astrocompass design but also to their application in flight are being solved. The performance of an astrocompass may be evaluated by the sensitivity coefficient K, suggested by L. P. Sergeyev. This represents the turn angle of the direction-finding plane of the instrument's sighting system around an axis perpendicular to the heading to the body for each degree of course change. The sensitivity coefficient of horizontal instruments is expressed by the formula:

$$K_{hor} = \cos h \quad (3)$$

while the sensitivity coefficient of equatorial instruments is expressed by the formula:

$$K_{eq} = \cos h \cdot \cos q, \quad (4)$$

where h is the body's altitude; q the parallactic angle, i. e., the angle between the body's declination circle and vertical circle.

These formulas show that the horizontal instruments are generally more sensitive than the equatorial and consequently perform more accurately and reliably. However, in polar regions, where the angle q is close to zero, the sensitivity coefficients of the equatorial and horizontal instruments are very close and therefore both types of instruments perform there with equal accuracy and reliability. The closer the flight region approaches the equator, the more pronounced becomes the advantage of horizontal instruments over equatorial.

It is also evident from formulas (3) and (4) that the sensitivity of astronomical course-indicating instruments depends upon the altitude of the body, h. The lower this altitude, the greater the sensitivity coefficient and hence the more accurate and reliable the performance of the astrocompasses. Thus, when taking a course bearing on the sun, it is most practicable to use astrocompasses in the morning and evening in polar regions and in winter, i. e., when the sun is closest to the horizon. Contrariwise, in the summer, during periods close to the moment of upper transit of the sun (around noon), the use of astrocompasses will be accompanied by maximum errors. It should be said that at the moment of transit, the parallactic angle of the sun is also close to zero, and

therefore the sensitivity coefficient values in formulas (3) and (4) will be identical in both horizontal and equatorial instruments.

Astronomical course-indicating instruments make it possible to solve navigational problems in plotting the true course and in flying an aircraft on a given loxodromic or orthodromic route.

Let us now examine the special features in solving each of these problems.

Taking an Aircraft's fix

When taking the fix of an aircraft, the astronomical course-indicating instrument must be in a strictly horizontal position. The AK - 53 p instrument is manually set in the horizontal position by using levels. The other instruments (DAK - I, DAK - B, and DAK - DB) have devices for automatic attitude correction. However, these instruments are based on the use of a pendulum or bubble level and therefore perform accurately only whenever there are no external accelerations, i. e., in a regime of straight and level flight or of uniform climb and glide, at constant airspeed.

In order to take a fix relative to the meridian of the aircraft's position, we must first set in on the instrument the coordinates (latitude and longitude). The accuracy of the fix in this case will be determined by the accuracy of the set-in coordinates. For horizontal course-indicating instruments, the accuracy of the fix may be evaluated by the following formula:

$$\Delta IK = \tan h \cdot \sin (A - \alpha_o) \cdot \Delta S + \tan \varphi \cdot \sin \alpha_o \cdot \Delta S, \qquad (5)$$

in which A and h are the azimuth and altitude of the celestial body; ΔS the error in the aircraft's position, i. e., the distance in degrees between the true position of the aircraft at the instant of the fix and the estimated position, the coordinates of which are set in on the instrument; α_o is the error heading of the aircraft's position relative to the meridian.

The first member of this formula expresses the error in determining the course due to the turning of the astrocompass's sighting system around the earth's center by the value ΔS; the second member expresses the error resulting from the convergence of the meridians between the aircraft's estimated and true positions. The maximum course error occurs when $A - \alpha_o = 90^o$ and $\alpha_o = 90^o$, i. e., when ΔS is mainly the result of inaccurately setting in the longitude at instants close to the body's transit. For these conditions formula (5) takes the following form (valid also for equatorial instruments):

$$\Delta IK_{max} = (\tan h + \tan \varphi) \Delta S. \qquad (6)$$

From this formula it is possible to obtain a relationship which allows us to solve the problem of the extent of permissible errors in the aircraft's position, the coordinates of which must be set in on the instrument:

$$\Delta S_{max} = \frac{\Delta IK_{max}}{\tan h + \tan \varphi} \qquad (7)$$

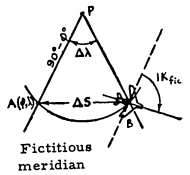
If a 2^o course error is accepted as the maximum permissible, then, when taking a fix on the sun in the summer (with declination $\delta = +20^o$) at its transit periods, we will have the following permissible error values in determining the aircraft's position at different latitudes:

φ^o	40	60	70	80	85
ΔS_{max} (km)	54	72	60	36	20

Thus, in order to avoid errors exceeding 2^o in fixing the true course, the aircraft's position — the coordinates of which are set in on the instrument at the moment of taking a fix — must be obtained with an accuracy of up to 40 - 70 km.

This condition becomes more rigid (less than 20 km) for high latitudes, and an accurate fix relative to the meridian of the aircraft's position is impossible in practice. Because of this, in polar regions the course is computed relative to any one fictitious meridian, the longitude of which is set in on the instrument. In this way we eliminate the error due to convergence of the meridians, i. e., the second member of formula (5). The accuracy of such a computation may be evaluated by the formula:

$$\Delta IK_{fic} = \tan h \cdot \sin(A - \alpha_o) \Delta S. \qquad (8)$$



Fictitious meridian

Fig. 2. Graphic function of longitude difference between the fictitious and true meridians.

For less favorable conditions, when $A - \alpha_o = 90^o$, this error takes on the value:

$$\Delta IK_{fic_{max}} = \tan h \cdot \Delta S. \qquad (9)$$

Consequently, the error will depend only upon the error in the position and altitude of the celestial body.

In polar regions, the sun's altitude is slight; therefore the error in determining the course by taking the bearing of the sun relative to the fictitious meridian will also be insignificant: it will not exceed one half the error in determining the aircraft's position ΔS expressed in degrees of an arc of a great circle. For example, when $\Delta S = 450$ km, the course error will not exceed 2^o (since each 111.2 km corresponds to 1^o of an arc of a great circle.

If we assume that the latitude of the aircraft's position has been accurately determined, then ΔS may be expressed as the longitude difference between the fictitious and true meridians, and we may thereby solve the problem of maximal permissible value of this difference.

In Fig. 2, point B is the true aircraft position, point A the estimated position on the fictitious meridian, the coordinates of which have been set in on the instrument. From the triangle PAB it follows that

$$\sin \frac{\Delta\lambda}{2} = \frac{\Delta S}{2(90^o - \varphi)}.$$

By substituting here the value ΔS from formula (9), we obtain:

$$\sin\frac{\Delta\lambda}{2} = \frac{\Delta IK_{fic_{max}}}{2(90^\circ - \phi)\tan h}. \qquad (10)$$

For the least favorable condition, let us assume a close to 30° altitude of the sun in this formula: then we can obtain the permissible longitude differences between the fictitious and true meridians $\Delta\lambda$ when $\Delta IK_{fix_{max}} = 2^\circ$.

Meridians at longitudes 0° - 180° or 90° - 270° have been adopted as fictitious meridians in the Arctic. The above permissible longitude differences confirm the possibility of using any one of the four indicated meridians (0°, 90°, 180°, 270°) which is nearest in longitude to the aircraft's position at latitudes of 85° and higher. At latitudes below 85°, the possibility of selecting one of the closest fictitious meridians will be determined by its longitudinal distance from the meridian of the aircraft's position and the altitude of the celestial body. The lower the altitude of the body, the slighter the course errors in computation relative to the fictitious meridian, and the greater the possibilities of using the fictitious meridians in solving a given problem.

ϕ°	80	83	85	86	87
$\Delta\lambda^\circ$	23	33	47	60	86

In computing the permissible range of longitude differences, we used the least favorable of possible conditions. But for all practical purposes it is possible to use, not the least favorable, but rather the average conditions. And the permissible range of longitude differences will be considerably broadened.

We will assume as initial data: $\phi = 80^\circ$, $h = 20^\circ$, $A - \alpha_o = 50^\circ$, $\Delta IK_{fic_{max}} = 3^\circ$. Then we obtain:

$$\sin\frac{\Delta\lambda}{2} = \frac{\Delta IK_{fic_{max}}}{2(90 - \phi)\tan h \cdot \sin(A - \alpha_o)} = \frac{3}{20 \cdot 0.365 \cdot 0.765} = 0.537; \quad \frac{\Delta\lambda}{2} \approx 32^\circ.$$

Hence it follows that $\Delta\lambda = 64^\circ$. This means that in practice the possibility of taking a fix on a fictitious meridian at 80° latitude increases 2.5 times. In addition, our calculation shows that taking fixes on a fictitious meridian is possible even farther south down to 70° latitudes.

When using the DAK - DB astrocompass with course corrector operating, it is necessary to consider certain special features of aircraft course computing. In this case, we can compute accurately only one orthodromic course which represents the angle of intersection of the orthodrome — over which the aircraft flies — with the meridian of the initial flight point (Fig. 3), the coordinates of which are set in on the instrument.

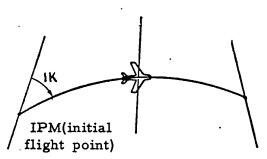


Fig. 3. Computing an orthodromic course by reference to the meridian of the initial flight point.

Since the movement of the aircraft is compensated in the course corrector by turning the sighting system about the lateral axis of the aircraft from the vertical towards the tail, such compensation is effective only for the direction of the orthodrome over which an aircraft flies. For all other directions it will be ineffective and may result in increased course computation error. Hence, it is expedient to compute an aircraft heading which does not coincide with the flight heading without resorting to the course corrector by first setting in on the instrument the zero values of ground speed and the distance covered, the latitude of the aircraft's position, and the longitude of the fictitious meridian. The method of computing a course in this case will be the same as for conventional horizontal instruments.

All astronomical course-indicating instrument make it possible to carry out a flight over a geographic loxodrome, while the DAK - DB astrocompass with the use of the course corrector also makes it possible to fly over an orthodrome. Flying with the aid of astrocompasses over a loxodrome has a number of peculiarities. Let us examine these. As is known, a loxodrome is a line intersecting all meridians with the same angle. Basically, the possibility of flying over a loxodrome when maintaining a constant course by astrocompass is determined by the fact that the astrocompass indicates the true course relative to the meridian being flown over — provided the coordinates of the true position of the aircraft have been set in on the instrument and there is absolutely no other course correction. Consequently, if, during the flight, we continuously alter the set-in longitude and latitude, adjusting them to the actual coordinates, and if we maintain the same course by astrocompass, then the aircraft will fly along a strictly geographic loxodrome.

Flying an aircraft on a planned route

However, the fact is that this cannot be realized with present-day astrocompasses. Latitude and longitude on the instrument are currently being changed periodically in flight at certain time intervals. This, of course, brings up the question: How often should the coordinates be reset and what path will the aircraft fly if a constant course is maintained by astrocompass on which unaltered coordinates — latitude and longitude — have been set in?

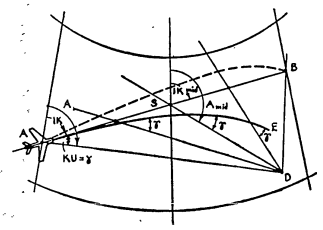


Fig. 4. Flying an aircraft by astrocompass with constant coordinates (for the midpoint of the rectilinear leg of the route).

Let us assume that, prior to starting the flight, we have plotted the route along the orthodrome AB (Fig. 4), have computed the true course from initial point A, and have set in on the instrument the latitude and longitude of this point. Let it be assumed that, at the instant of reaching point A, the geographic position of the celestial body was at point D. Since the astrocompass has a mechanism for the correction of the diurnal motion of the earth — a mechanism which compensates for change in azimuth due to the altered geographic position of the body — point D can be taken as the fixed pole of a certain new system of spherical coordinates, and the vertical circles

AD, CD, BD, and so on, as the meridians of this new system.

Since the compass has a mechanism for correction of the diurnal motion of the earth, we may assume that the azimuth of the body is constant at each point and depends only upon the coordinates of that point. Consequently, by maintaining a constant true course by an astrocompass on which the constant coordinates of point A have been set in, the aircraft will intersect all new meridians with the same course angle γ. Actually, if both the azimuth and the course are constant, then the course angle equal to $\gamma = A - IK$ will also be constant.

Hence the conclusion follows that flying by astrocompass with constant coordinates proceeds along a certain astronomical loxodrome (curve AE) within a system of such coordinates, the pole of which is the geographical position of the celestial body at the instant the aircraft reaches the initial point of the route.

It is a known fact that a loxodrome is a spiral which always coils towards the pole. This means that, if we maintain the course of the initial point of the route, having set in in advance on the instrument its latitude and longitude, the aircraft will always sheer from the planned route toward the celestial body. It is quite apparent that, in order to reach the planned terminal point of the route (point B), it is necessary to lay the course by setting in the latitude and longitude, not of the initial point, but rather of a certain alternate point C. For this purpose usually a midpoint on the rectilinear leg of the route is selected. The flight will then proceed along an alternate astronomical loxodrome (dotted line), following which the aircraft will at first deviate from the planned path in a direction opposite to that of the celestial body; then it will approach the planned path and intercept it somewhere near the KPM [terminal point of route]. Maximum deviation of the astronomical loxodrome from the orthodrome depends upon

h \ S	2°	4°	6°	8°	10°
10°	0,4 км	0,9 км	1,8 км	2,8 км	4,1 км
30°	1,1	1,8	4,6	9,3	14,0
50°	2,4	4,6	10,5	18,5	29,6
70°	5,5	11,0	24,0	43,0	63,0

the altitude of the body, h, the length of the leg, S, and attains the following maximum values when the body's course angles are 90° and 270° (See table).

It is evident from the table that when the altitudes of the body are low (up to 30°) the maximum lateral deviations of the astronomical loxodrome from the orthodrome on legs of up to 700 km are insignificant (less than 5 km) and they may be actually disregarded — assuming that the flight proceeds essentially along the orthodrome. At star altitudes ranging from 30° to 50° lateral deviations may be disregarded for legs of

up to 500 km, and at star altitudes of from 50° to 70° — up to 300 km. The above ratios are also used as a basis for the maximum frequency of setting in coordinates: at star altitudes up to 30°, every 700 km; at altitudes of 30° - 50°, every 500 km; and at altitudes of 50° - 70°, every 300 km.

On the basis of these ratios, it is possible to draw certain conclusions regarding the use of the astrocompass in fighter aircraft. The fact is that any additional computations and manipulations of the instrument are undesirable for a pilot flying a single-place aircraft. All initial data for the astrocompass of a single-place aircraft should therefore be set in on the ground prior to takeoff.

When setting in in advance on the instrument the declination and the Greenwich hour angle of the body, there can be no question of uncertainty, since the declination may be considered constant, while the change in the hour angle is continuously compensated by the operation of the clock mechanism. In evaluating the possibility of setting in in advance the latitude and longitude of the aircraft's position prior to takeoff, we can use the permissible deviations from the planned route as a basis and, provided these deviations are less than 5 km, we may consider it feasible to set in in advance the airfield coordinates on the astrocompass for all flights to be made within a radius of 250 - 300 km — provided the altitude of the celestial body is within the range of 30° - 50°.

At high altitudes the possibility of using the airfield's constant coordinates diminishes, while at low altitudes the possibility expands considerably; these facts are of practical interest for a fighter aircraft which often takes off on a mission without preliminary layout of the route. However, in this case, it is necessary to consider all the special features of flying with constant coordinates. Specifically, if the readings of the astrocompass are used for cross-checking the readings of other compasses, it is expedient to correct the latitude and longitude on the instrument, approximating them as closely as possible to the actual position of the aircraft. However, if the flight follows a previously known route which runs a great distance from the field, the coordinates of the route's midpoint should be set in on the instrument instead of the airfield's coordinates.

Thus we arrive at the conclusion that, by maintaining a constant heading by astrocompass, the aircraft will fly on the geographic loxodrome, provided the actual coordinates of the position are continuously set in on the instrument. If we set in constant latitude and longitude values on the instrument, the aircraft will follow an astronomical loxodrome with a turn towards the celestial body.

In order to travel over a planned route, it is necessary to divide this route into several rectilinear segments of 300 - 700 km in length (depending upon the mean altitude of the body); on each of these segments it is necessary to set in the midpoint coordinates for the given leg while maintaining the true course relative to the midpoint's meridian. In polar regions we may use a single grid of fictitious meridians. We then set in on the instrument the latitude of the route's midpoint and the longitude of the particular fictitious meridian (0°, 90°, 180°, or 270°) relative to which the aircraft's course is maintained.

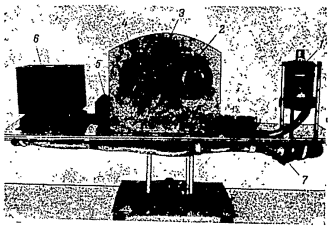
The flight over a route with midpoint coordinates of each of its separate legs will proceed along a broken line approximating the orthodrome in each of its segments. A strictly orthodromic flight is possible only with the DAK - DB with course corrector switched off. For this purpose it is necessary to set in on the instrument the coordi-

nates of the initial point of the route's leg, and to maintain the course plotted at the meridian of the initial point. When the route is broken or when any leg is longer than 1000 km, the aircraft position coordinates and the flight course should be altered correspondingly and adjusted to the initial point of the new leg.

In all navigational computations involving the use of astrocompasses it is necessary to take into consideration the wind just as when flying with conventional magnetic or gyro course-indicating instruments.

Astronomical Course-Indicating Instruments

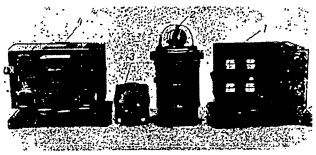
DAK-1



DAK-I [Distant-Reading Astrocompass — Fighter]

The distant-reading astrocompass for a fighter is built on a horizontal system and is used for determining the true course and for flying an aircraft over a planned course when the sun is visible. It is also used as a true-course transmitter for the DG-MK [Distant-reading gyromagnetic compass] gyro system and other compasses with magnetic transmitter switched off. Included in its basic units and mechanisms are: course-angle transmitter with photoelectric servo system (1); azimuth mechanism with coordinate platter (2); operational control knob (3); course indicator (4); junction box (5); amplifier (6); and power transformer (7). The diurnal motion of the earth is compensated by a clock mechanism and a special device — the azimuth plotter. For compensation of aircraft bank the sighting system is mounted in a pendulum suspension. Solar bearings are taken automatically by means of photoelectric cells having a 360° circular scanning field. The latitude and longitude of the position, the hour angle and the declination of the celestial body are usually set in prior to flight but may also be corrected in flight. The instrument is used within the range of 40° - 90° north latitude and in the entire range of solar declinations ± 23.5°. The accuracy in determining the true heading is within 2° - 3°.

DAK-DB



DAK-DB [Distant-reading Astrocompass — Long-range Bomber]

The distant-reading astrocompass for a long-range bomber is built on the horizontal system and is used for episodically plotting the true course by the sun, for flying an aircraft along a planned orthodrome or loxodrome when the sun is in view, for plotting the true course at night by any celestial body with conjoint use of the SP-1 sextant and with automatic feeding of the true course into the automatic navigational devices and into the radio compass.

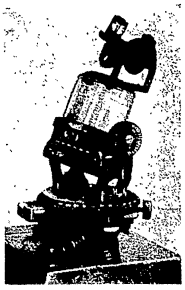
The basic units and mechanisms of the compass are: computer with control panel and coordinate plotter (1), course-angle transmitter with photoelectric servo system (2), course corrector (3), amplifier unit (4).

The diurnal motion of the earth is automatically compensated by a clock mechanism and spherant. Aircraft banking errors are compensated in the astrocompass by a special pendulum corrector which works out course corrections. The latter are fed directly into the course indicator. It has automatic course correction for flights over an orthodrome.

The astrocompass is coupled to the SP-1 periscopic sextant which, when pointed toward the celestial body, automatically gives the true course of the aircraft in the compass. To do this, δ and t_{gr} of the given body must first be set in on the instrument.

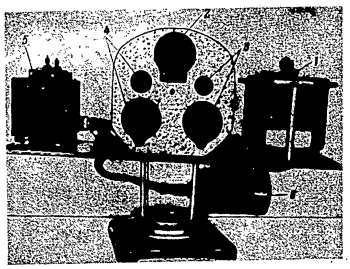
The instrument is used in the range of 40° to 90° north latitude and in the range of the celestial body's declination from -30° to + 60°. The course corrector operates at ground speeds of 200-1100 km/hr. on a rectilinear leg of up to 1000 km. Its accuracy of measurement is within 2° - 3°.

AK-53p



The AK-53 p astrocompass combined with polarizing attachment is constructed on the equatorial system. Its function is to plot the true course of an aircraft by any celestial body in day or night as well as in twilight by reference to plane polarized scattered sunlight. It has three sighting devices as well as mechanisms and scales for setting in the latitude and longitude of the position, the hour angle and declination of a celestial body. The sighting system for shooting the sun is connected with a clock mechanism which compensates for the diurnal motion of the earth. On top, for shooting the moon, planets, and stars, there is mounted a sighting device, in the center of which is installed the polarizing attachment. It can be employed for all latitudes from 0° to $\pm 90^{\circ}$ and for all declinations of celestial bodies from 0° to $\pm 64^{\circ}$. Accuracy in plotting the true course is within $1^{\circ} - 2^{\circ}$ and by polarized light within $2^{\circ} - 3.5^{\circ}$.

DAK-B



The DAK-B is a distant-reading astrocompass for a bomber (on the equatorial system). By using this instrument the true course is plotted and the aircraft is flown on a planned course in daytime by taking bearings on the sun. The whole consists of the following basic units and mechanisms: course transmitter with photoelectric servo system (1); coordinate plotter (2) with a clock mechanism; sun search knob and pilot's course indicator (3); sensitivity control with sun search knob and navigator's course indicator (4); amplifier (5); and power transformer (6).

The diurnal motion of the earth is compensated by a clock mechanism. There is correction for longitudinal inclination made by the aid of a special bubble level with an electric circuit breaker operating within $\pm 8^{\circ}$ of longitudinal inclination. Shooting the sun is done automatically by means of an electric drive controlled by a photocell (at initial declinations from direction to the sun of not more than $\pm 15^{\circ}$). Time for 360° adjustment is 12 seconds. It is used within the limits of $+45^{\circ}$ to $+90^{\circ}$ north latitude, and in the entire range of solar declinations $\pm 23.5^{\circ}$. Accuracy in determining the true course is within $2^{\circ} - 3^{\circ}$.

IN THE DRIVE TO IMPROVE THE QUALITY OF NIGHT BOMBING

Capt. K. M. Karasev

In the course of training young navigators in night bombing with the radar sight, it is quite important right from the beginning to draw their attention to the importance of accurately calibrating the sight, knowing how to secure a clear target image on the TKO [PPI scope], and accurately setting in the data on the altitude drum, since all these factors determine, to a critical degree, the results of a bombing operation.

Accurate calibration, in turn, involves accuracy and precision of performance on the part of the navigator, while the clarity of the image on the sight depends on how well the receiver is adjusted, how the antenna is positioned, how the light intensity is regulated, which image scale is set, etc. For operating aloft it is far from being sufficient to know, let us say, only how to tune a station or how to calibrate it. A definite sequence of operations is very important both when switching on, tuning, and calibrating a station, and when carrying out duties on the bomb run.

A navigator who does not observe with a radar station the standard operating procedure which he developed during training usually fidgets too much and often makes errors. He either turns the wrong knob on the potentiometer panel shield, attempts to correct the position of the altitude drum by reference to the altitude ring with a sighting angle of 60°, or else he shuts off power altogether instead of switching on the "sector" control. Such a navigator is always afraid of not completing the calibration, of not correcting the position of the altitude drum, and of not sighting before entering the bomb run.

We once had a case when a young navigator, because he had assumed an incorrect position in the aircraft cabin and because of his excessive fussing on the bomb run, forgot to close the potentiometer panel shield and inadvertently disturbed the calibration with his foot. Although this error was noticed, still, in order to correct it, a repeat run was required. Another navigator, while executing a night bombing mission, forgot to introduce the trail into the sight and became aware of this only after the first bomb had been released with a considerable short.

There are times when gross errors are made, such as calibrating on the wrong ring, using the wrong knobs, or sighting with random settings on the altitude drum, etc. Certain of these regrettable errors may lead — especially at night — to dropping bombs outside the bombing-range perimeter.

The lead navigator should be the first one to see to it that such shortcomings are not repeated, since it is unthinkable to learn through experience of such errors at the cost of mission aborts. If, for instance, the navigator in flight forgets to set in the trail on the sight, then, in analyzing this flight, the attention of the trainees should be drawn, not so much to this fact, but rather to its causes. The causes, as a rule, lie in the fact that the navigator is not sufficiently methodical in his work with the radar station, has not yet learned to organize efficiently his cabin duties — all of which, in the final analysis, results in incorrect distribution of attention. In the given case the

navigator lacked the necessary breadth of attention to check the setting in of the sight data.

In our unit we train the navigators in sight calibration in stages. For instance, after readying the sight for calibrating with respect to three points, i.e., having set the altitude drum at minimum value, the sighting angle β to 0°, the maximum scale, the front sector, "OPB" [bomber optical sight] regime, and having turned down the high frequency amplification, the navigator, if necessary, may divert his attention temporarily to observe the flight regime, orientation procedure, etc. After this, he starts calibrating zero range. When he has finished this, he diverts his attention again, and then starts calibrating the point "10-0".

Having developed in himself habits of working aloft in stages, the navigator gains confidence. He will no longer be confused if the necessity arises of temporarily interrupting the calibration, since he has become accustomed to integrating the various elements of his work. In the course of bomber training instruction, the navigators become accustomed not only to a standard operating procedure with the apparatus but also to meticulousness and to economy of motion. The very mode of hand and head movement when working with the radar station must stress accuracy, precision, and sureness of action.

For example, having set in — prior to calibration — the minimum altitude with the altitude drum and the sighting angle $\beta = 0°$, the navigator must without fail check his settings by the light of an extension lamp; then, as he begins calibration, he must carefully manipulate the different knobs on the potentiometer panel shield while facing the latter. This seems such a trifle — but sometimes a great deal depends on it. One little slip — and the efforts of the entire aircraft crew may come to nought. That is why our experienced navigators are constantly stressing the fact that even during the bomb run an extension lamp should always be in hand and should be used periodically to illuminate the drift angle scale (particularly at the start of the bomb run) in order to preclude accidental change in the BURP [bomb-run angle of the radar sight].

The necessary habits are acquired in special trainers or in an aircraft cabin. The attention of the trainees is drawn here to the transitional moments between stages of operation. Sometimes it happens that, after correcting the position of the altitude drum, the navigator forgets to set in the sighting angle $\beta = 70°$, and thereupon enters the bomb run.

Such errors may be completely precluded if the whole process of operations in correcting the altitude is made final, not by aligning the altitude ring with the bombing marker, but by setting in the sighting angle $\beta = 70°$, the antenna elevation angle 10 - 12°, and the small scale on the TKO.

By analogy with the above example, the navigator, after completing calibration of the station, in one single complex of operations sets the switch in "operating" position, sets the altitude drum at the bombing altitude, and sets the sighting angle at $\beta = 0°$. That is, he sets everything in the initial position for the following stage: — altitude correction.

If it is not possible for all the navigators to use special trainers for acquiring and establishing correct habits, then it is recommended that special attention be given to instruction in the aircraft cabin when training for night bombing operations. As necessity indicates, the radar sight may be switched on, while during the other stages the instruction may be conducted with the sight switched off.

Only that navigator who does not conceal his own errors and who is able to analyze correctly the errors made by his comrades can truly perfect his combat skills in such a difficult sphere of combat training as night bombing. The task of a lead navigator is to assist in approximating as closely as possible the theoretical aspect to the practical aspect of bombing; to reduce the most typical and frequently recurring errors to common terms; and show ways of eliminating them.

For instance, after one flight the navigator reported that the target on the bomb run did not initially "slip" in any direction and about ten degrees before bomb release it only shifted a little to the side. After a corrective turn was made with a "double take", the target began "slipping" quickly in the opposite direction; consequently it was necessary to make energetic corrective turns immediately before bombs away. A considerable bomb deflection in range and direction resulted. The crew tended to attribute this failure to a poorly functioning autopilot (it did not bring the plane out of the turn, made poor corrective turns, etc.).

But after a close analysis of this flight it became clear that it was not a question of the autopilot. It turned out that the navigator was tracking the target from sighting angle of $\beta = 69^\circ - 45^\circ$, after which he attempted to correct the crosstrail setting with a "double take". However such a procedure is incorrect, since in order to crosstrail with a "double take" in the given instance the coefficient of multiplicity should have been equal to:

$$K = \frac{\tan\beta_o}{\tan\beta_o - \tan\beta} = \frac{2.6}{1.6} \approx 1.6.$$

But the fact is that the sight's coefficient of multiplicity K is equal to 6.7. Therefore the multiplicity error came to:

$$\Delta K = 6.7 - 1.6 = 5.1.$$

Thus, if the BURP error was 1°, then after the corrective turn the drift angle error is:

$$US[\text{drift angle}] = \frac{\Delta K}{K} \cdot \Delta BURP = \frac{5.1}{1.6} \cdot 1^\circ \approx 3^\circ,$$

i.e., actually the target should "slip" in the opposite direction with three times more intensity, and at shorter slant ranges this becomes particularly marked. Forced corrective turns (especially when abrupt) before bombs away lead to range errors as well, since the autopilot in such cases does not always maintain the planned altitude, and — as we know — altitude errors have a very strong effect on bomb range deflection.

How may such errors be avoided?

In order to crosstrail with a "double take", a linear base equal to $\frac{1}{6.7}$ the original distance to the target must be maintained, while range sighting requires maintenance of a different base, namely, one third the bomb's time-of-fall.

For actual conditions it is possible to select such an initial sighting angle β_o with which the aircraft will travel $\frac{1}{6.7}$ the distance to the target in the time $\frac{T}{3}$. Let us combine these two conditions

$$\begin{cases} \tan\beta_o = 6.7\,(\tan\beta_o - \tan\beta) \\ \dfrac{H(\tan\beta_o - \tan\beta)}{W} = \dfrac{T}{3} \end{cases}$$

and we find that:

$$\tan\beta_o = \frac{6.7\,WT}{3H} \approx \frac{VT}{0.45H} \quad (\text{assuming } W = V).$$

Then β_o will be that sighting angle from which it will be necessary to reckon the time $\frac{T}{3}$; after this it will be necessary to synchronize and to crosstrail with "double takes". If we calculate the numerical values of $\tan\beta_o$ (for altitudes and speeds at which crews actually perform night bombing) and tabulate them, the obtained values for bombs with $\Theta = 21.00$ will be within the limits 2.2 to 2.8.

A navigator on a night mission does not find it very convenient to use every time $\tan\beta_o$ which has been either specifically selected from the tables or computed. Therefore there is good reason to examine the type of error that will occur in the drift angle if we assume $\tan\beta_o$ as constant for all cases.

After the navigator switches on the ground speed servo and after the target signal reaches the crosshairs of the radar sight, and before he adjusts its position, the sighting angle actually is $\beta \approx 69^\circ$. If we take $\beta_o \approx 69^\circ$, then $\tan\beta_o = 2.6$. On the other hand, for some bombing situations we find a table value of 2.2.

An error in $\tan\beta_o$ ($\Delta\tan\beta_o$) will result in a multiplicity discrepancy amounting to ΔK. Inasmuch as

$$\tan\beta_o = \frac{WT}{3H} K,$$

it follows that

$$\Delta\tan\beta_o = \frac{WT}{3H} \Delta K,$$

or (if the obtained expression be divided by the preceding equation):

$$\frac{\Delta\tan\beta_o}{\tan\beta_o} = \frac{\Delta K}{K}. \qquad (1)$$

The multiplicity discrepancy will in turn result in a drift angle error ΔUS. Since $US = XK$ (where X is the value of the target "slip"), $\Delta US = X \cdot \Delta K$. Therefore:

$$\frac{\Delta US}{US} \quad \frac{\Delta K}{K}. \qquad (2)$$

Combining formulas (1) and (2) we may write:

$$\frac{\Delta\tan\beta_o}{\tan\beta_o} = \frac{\Delta US}{US} \cdot 100\%.$$

Therefore, if instead of the requisite value $\tan\beta_o = 2.2$ which satisfies certain definite requirements, actually under the same conditions the value

$$\tan\beta_o = 2.6 \quad (\Delta\tan\beta_o = 0.4)$$

is used, then

$$\frac{\Delta US}{US} = \frac{0.4}{2.2} \cdot 100 \approx 20\%,$$

i.e., the drift angle error will constitute 20% of the actual value.

If the navigator, even before acquiring the target on the radar sight's crosshairs, selects the BURP with an accuracy of 5 - 10°, then the error ΔUS may only amount to 1 - 2° after the turn; and the navigator, besides, has the additional opportunity of even correcting the crosstrail several times more.

It is apparent that reckoning the time base $\frac{T}{3}$ helps the navigator to coordinate the movements of the drift and synchronizing crank handles, and eliminates to a considerable degree any disorderly haphazard movements. Our experienced navigators such as B. I. Zhubrzhitskiy, A. G. Belotserkovets, prefer to control the base by mental timing and they consistently achieve excellent bombing results. And young navigators who are just beginning night bombing practice are — in their seniors' footsteps — also achieving good results.

The basic task of night bombing training consists of inculcating in the navigator such efficient and theoretically sound operational procedures which will direct him along the path toward perfecting his combat proficiency.

ELIMINATING ERRORS IN THE PILOTING TECHNIQUE OF TRAINEES

Lt. Col. A. R. Yepifanov

In analyzing the results of flight work, a great deal of attention is allotted in our school to a study of the experiences of topnotch instructor pilots and of commanders who for many years have been carrying on flight training without flight accidents.

Take, for example, instructor pilot Capt. B. P. Lupandin, who has now been promoted to the position of element commander. During the course of seven years he has been training student pilots without any flight accidents. And the flying personnel of officer A. I. Kozlov's outfit has been also fulfilling the schedules of flight training duty for six years without any accidents. We could name a number of other commanders and instructors who have achieved comparably good results.

But unfortunately not all instructor pilots have been training their students in an equally qualified manner. The necessity has long since been felt for studying the characteristic errors in piloting technique and for drawing up unified methods for teaching students to correct these errors. On the basis of the advanced experience at our school we have elaborated the basic principles of such a methodology; we have discussed them at flying personnel assemblies, after which they were confirmed by the command; and now they are being used as a guiding methodological aid. Classes in methodology under the direct guidance of officers V. F. Anosov and I. M. Tayver have been conducted with the flying personnel in all the outfits, and, later, pattern and zone demonstration flights were conducted.

We consider that the basic instruction method for correcting errors in piloting technique is in-air demonstration.

Teaching students to correct errors directly in the air follows only after they have fully mastered the maneuvers or elements of flying. Then they will be able more clearly and exactly to determine the aircraft's deviations from the norm and they will learn to counter them correctly. The task of the instructor during the flight is to introduce the error in a methodologically efficient manner, call the attention of the student to the aircraft's behavior and attitude in space, and demonstrate how the control surfaces must be operated in order to correct the error competently.

We teach the correction of errors in piloting technique during instruction flights provided for in the course schedule. In case of necessity, additional instruction flights are also planned.

It is very important to stress the fact that in the process of training students, their individual characteristics must without fail be taken into consideration. Thus, instructor pilot Capt. A. M. Totskiy, by observing every student in the group attentively, ascertained that I. A. Shangurov mastered the flying program well but quickly lost the habits he had acquired. The instructor trained him to correct his errors in the course of the entire flight training program. Student S. V. Sachkov, on the other hand, learned the flying program slowly but retained it well. A different training method,

therefore, was applied to him. Element commander Capt. G. P. Denisov prescribed additional instruction flights for him, striving to see that Sachkov thoroughly mastered any one given technique for executing advanced maneuvers and for correcting possible errors.

Let us examine the most characteristic errors in pattern flight on a UTI [advanced fighter trainer] MiG-15, and also methods for teaching the correction of those errors.

During takeoff from a dirt field the most typical error of students is that they pull back prematurely on the control stick in the first half of the takeoff run. Inasmuch as the plane at this time still does not have the necessary speed and the elevators are insufficiently effective and cannot give it the angle of attack necessary for the takeoff, the front wheel does not lift. With an increase in forward speed, the plane may raise its nose sharply and, assuming larger angles of attack, lift off at low speed or touch the ground with the tail section of the fuselage.

After a normal takeoff has been completed with the student, the instructor demonstrates 2 - 3 takeoffs with such an error. During the first half of the takeoff run, at a speed equal to 150 km/hr, he pulls back the stick to the position necessary for normal lifting of the front wheel, and he calls the student's attention to the aircraft's behavior. At the same time, pushing the control forward, the instructor counters the tendency towards excessive lifting of the front wheel. Then, together with the student, he again carries out correct takeoffs, so as to restore correct habits before solo flight.

Much more complicated is the process of teaching the correction of errors during landing computation and landing. Incorrect distribution of attention, faulty correction of an error during landing can entail serious consequences. We know, for example, that student K. K. Stepetskiy, who was trained several years ago in officer G. M. Oleykin's group, during one of his flights after having finished school, rounded out too high while landing and was not able to correct the error in time. That means that formerly we did not do everything to see to it that our graduates should be able at any moment to correct an error they had made.

At the present time, while carrying out an exercise in the check-flight program, the instructor very attentively sees to it that the student gets ready for the landing in time, and that in all instances, from an altitude of no less than 50 m and up to the beginning of rounding out, he glides at a constant angle at the prescribed speed; and that at an altitude of 30 m he shifts his glance to the ground — to the left and forward — toward the place to which the plane is descending. Thus the pilot learns to estimate precisely an altitude of 6 - 7 m and to begin and complete the roundout in due time.

For the practical demonstration of the technique of eliminating errors during landing, up to 10 flights for each student are planned at our school: for one flying day usually 3 - 4 flights and 4 - 6 for the next. But between the third and fourth flights a break is consistently taken and, at the flight line, a brief critique is conducted of the exercises which have been carried out.

During the first flight, excessively high rounding out is demonstrated and corrected. For this purpose, speed during gliding is maintained at 10 - 15 km/hr greater than that prescribed. At an altitude of 8 - 10 m the instructor begins the roundout at the usual rate of speed and completes it at 1.5 - 2 m.

After noticing the high roundout, the student must stop pulling back any further

on the stick and must allow the plane to descend; or, if it does not descend, he himself must bring it down to an altitude of 1 - 0.75 m. Then, pulling back on the stick smoothly and steadily, he lands the craft on the two main landing wheels. The instructor checks his operations and if the student is late in correcting the high roundout, then he himself corrects the error and completes the landing without too much float at an altitude of 1.5 - 2 m and without too great a loss of speed.

In exactly the same way, during the second flight as well (correction of ballooning) after the instructor sets up the ballooning error prior to an altitude of no more than 1.8 m, the student himself must correct it. However, if his reaction is inadequate, then the instructor steps in and takes over the controls.

A flight for making an exact computation and for correcting "bumping" requires a great deal of attention on the part of the instructor. The computation is corrected by prolonged back-stick pressure while flying in a position which is horizontal or close to it. The pulling back is carried out by the student. During gliding the speed exceeds by 10 - 15 km/hr that which is prescribed. Rounding out the plane at an altitude of 0.7 - 1 m, the trainee plots a landing with a normal profile. During the first half of the float period, the instructor delays applying back-stick pressure and lands the plane at an increased speed (210 - 220 km/hr) with a landing angle close to the line of horizontal flight (the front wheel is approximately 10 cm off the ground). At the moment the main wheels touch the ground, the stick is pulled back gently — and a high-speed "bump" occurs.

The student must evaluate the situation and correct the error. Depending on the speed of the aircraft, he prevents it from lifting off the ground again by gentle and moderate forward-stick pressure, and then, by applying back-stick pressure, lands it on the two main wheels. It must be kept in mind that when the "bump" occurs late (touchdown on the two main wheels at a normal or slightly increased speed of 170 - 190 km/hr with forceful application of back-stick pressure), the plane balloons at 1 - 1.5 m and rolls onto a wing with nose down. This is a no-speed "bump" which can only be the result of faulty actions by the instructor. It ought not to be introduced for training purposes. Such a "bump" must be corrected at once by the instructor himself.

Two flights are scheduled for the student for training in the go-around technique. In the first one, he receives the order to go around again after the fourth turn at an altitude of 50 - 60 m with rpm down to idling. After receiving the order, the trainee advances the engine smoothly to full rpm and, when the speed reaches 300 km/hr, he begins to climb, retracts the landing gear, and, with a constant increase in speed, he goes around again.

During the second flight, the go-around is made from the float altitude. Gliding is carried out with rpm completely retarded to idling speed as far as an altitude of 7 - 8 m, after which the student is given the command to go around again. Continuing the landing (his glance is directed onto the ground), he smoothly advances the engine to full rpm. The instructor observes the direction of the student's glance, the rate of speed of the plane's roundout and smoothness in advancing the engine to full rpm, corrects the student's actions on the SPU [aircraft intercommunication system] or resorts to dual control if the trainee is making serious errors.

We will note, that in going around from a low altitude, students frequently make an error— they look away from the ground and the plane touches the ground with its

wheels with a subsequent sharp ballooning and a shift to high angles of attack with loss of speed. The error is sometimes aggravated further by a sudden advance of the throttle. Therefore the instructor is obliged to evaluate the student's actions critically.

After the go-around, the student carries out an entire flight, computation, and landing with speed brakes down and with the throttle completely retarded at an altitude of 50 - 70 m. The instructor calls his attention to the glide angle and the poor effectiveness of the speed brakes at low speed. The trainee must become convinced that the computation and the landing with speed brakes down present no difficulty.

For the same purpose, an instruction flight is carried out with the speedometer pasted over. The student comes to understand that piloting a plane without that instrument is entirely possible.

In this way we analyze several pattern flights which are especially schedules for the student in order to eliminate errors in piloting technique. Besides these, 3 - 4 flights more are given to repeat what the instructor considers to have been inadequately mastered.

During 1 - 2 flights the instructor, at any point on the route (that point is indicated by the operations officer during preflight training as it applies to the flight line) at an altitude of 500 m, reduces the rpm to 5,000 - 6,000 and simulates engine failure. A drop of no more than 200 m is allowed. The task of the student is to create a glide angle and indicate the spot where he has decided to land.

In order to train students to reach a decision in case of engine failure and to correct errors in landing, we must not limit ourselves only to carrying out the flights that have been analyzed. The training must be continued in subsequent pattern and zone exercises so that in case of necessity each student will be able to reach a correct decision in due time and to carry it out to its conclusion in any flight.

It is quite clear that a demonstration of typical errors in the process of piloting in the zone and the technique for correcting them are also included in the training of the students.

Thus, for example, when turns are worked out on a MiG-15 plane, the most characteristic deviations from the norm are inconsistancy of banking and of angular rotation and the failure to maintain prescribed altitude and speed. These errors occur because the extreme wing sweepback and the short nose section of the aircraft with the forward location of the cockpit hamper the determining and holding of the bank during a turn by judging the position of the cowling with respect to the horizon, while the comparatively high thrust range of the engine complicates the maintenance of the prescribed altitude and speed.

The instructors help the students overcome errors of a similar nature and, to the extent that the technique of piloting is mastered and the special features of the plane are learned, these errors are as a rule eliminated. However, besides these general errors which depend on lack of experience, there are also those the mandatory correction of which is dictated by the interests of flying safety.

Among them are: pulling too hard on the stick during a turn; "nosing down" of the aircraft while entering a turn or in the process of executing one; a climbing turn. Pulling too hard on the stick is the most frequently occurring error during a combat procedure turn as well, and it arises as the result of the inability to determine the aircraft's angular rate of rotation. In addition, during a combat procedure turn, students most frequently increase the bank excessively or else recover at too low a speed.

The following errors are characteristic of a roll: off-course recovery; hovering of the plane in inverted position; pulling too hard on the stick during recovery from a dive. The dive itself may be executed with a bank or a turn, and this too is the result of incorrect operations. When going into a dive (this happens especially often on the bombing range during target approach) students make a steep bank.

Working out Nesterov loops with students is connected with the mandatory elimination of such errors as reducing speed at the top point, pulling too hard on the stick during the first and second half of the loop, executing the loop in more than one plane. For the Nesterov half loop the same errors are characteristic as during the first half of the full loop, and when the craft rolls around its longitudinal axis at an angle of 180° — deflections inherent in a barrel roll, i.e., erratic rotation or nosing down of the plane and nosing down in a belly-up position.

As an example of the methods we employ in our work, let us examine in greater detail the spiral and the errors connected with it. One of these is excessive increase of the angle of descent as the result of violating the prescribed angle of bank and angle of incidence of the longitudinal axis of the plane with respect to the horizon, or as the result of incorrect operations by the trainee in maintaining the prescribed forward speed (the bank is not maintained, and the increase in speed is countered only by pulling back on the stick). The characteristics of such an error are rapid increase in forward speed and loss of altitude, increased bank, and increased acceleration forces.

Training the student in the air in such a case amounts to the following: when going into the spiral, the instructor increases the bank angle to 60° and demonstrates the wrong way (by pulling back on the stick) and then the right way to bring the plane out of the spiral (he pulls it out of the bank and, depending on the situation, continues the descent at a gentle glide or again in a spiral). After that, the instructor introduces the error and this time the student corrects it. During the established spiral the instructor demonstrates — and the trainee imitates — what must be done in order to maintain the prescribed bank and the plane's angle of descent.

Another error during a spiral is pulling back too hard on the stick as the result of the inability to maintain forward speed and to correlate the angular speed of rotation with the size of the bank. The plane begins to quiver and there is a tendency to lose speed. The error is corrected by relaxing pressure on the stick until the plane ceases to vibrate. At first the instructor demonstrates how this is done and then he introduces the error again for the student to correct on his own.

If the plane is put into a spiral with a low angle of descent at the prescribed — but not yet established — speed, the forward speed will drop. The same thing will also be brought about through a decrease in the angle of descent during the spiral. The error is corrected by bringing the plane out of the maneuver and by repeatedly bringing it into a spiral in a coordinated manner. In the air the instructor introduces the error intentionally and the student corrects it at his command and under his observation.

In actual practise, the plane often falls into a so-called steep spiral. This occurs if errors made during a sharp turn when rolling out of a combat procedure turn during an ordinary spiral were not corrected in time. Another cause of a steep spiral may be the failure to put a prompt stop to a slow rotation of the plane around its longitudinal axis during recovery from a dive. It is usually caused by the ailerons' being in a nonsymmetrical position in relation to the airflow or by the rudder in case

of disturbance of the aerodynamic symmetry of the plane (skin damage) or in case of insufficient wing rigidity. It may also be caused as the result of excessive increase in speed during a dive.

In this connection, the spiral may be very elongated with a high angle of incidence of the aircraft's longitudinal axis with respect to the horizon.

From the ground only a discrete terminal segment of a spiral 2500 - 3000 m in depth is visible during which the plane manages to turn one seventh or one eighth a full coil (the time for one coil is approximately one minute) and is consequently taken for an ordinary dive. Such a spiral may appear to be an ordinary dive not only to the observer from the ground but even to the pilot himself.

When recovering from an ordinary dive, the pilot sees the ground through the cockpit canopy windshield moving from above to a direction under the plane; and sometime later he sees the approaching horizon. Meanwhile the AGI-1 [gyrohorizon] shows neither a turn nor a slip, i.e., the meridian line and the ball are in the center. During a steep spiral the pilot sees the ground through the windshield moving also from above in a direction under the craft, but slightly inclined (if there are no good landmarks, this visible incline of the earth's surface to the aircraft's plane of recovery from a dive may even go unnoticed), and the horizon will pass to the side of the outer wing and not approach the windshield. The meridian line will show a turn on the bank scale, and the ball will move in the direction of slipping or remain in the center.

If the pilot does not determine where the horizon is and does not notice a turn of the plane (and he will not notice it by merely observing the ground through the windshield instead of checking the instrument readings), he will easily take a steep spiral for a normal recovery from a dive. This distorted perception is intensified also by the fact that during a steep spiral, just as during recovery from a dive, the pilot is pressed to his seat and he feels normal pressure on the control stick. Puzzled by the prolonged "non-recovery" of the plane from the dive, he pulls back more forcibly on the stick, whereupon he feels increasing acceleration forces and pressure on the elevator, sees the increased motion of the earth's surface from above in a direction under the plane, but the expected recovery from the dive does not materialize.

Actually, however, the forward speed increases swiftly, altitude is lost very rapidly, and there may not be sufficient altitude for recovery of the plane (which occurs very slowly) by means of the control stick alone. And, indeed, pulling back on the stick in such a case will only speed up the plane's rotation and increase the angle of descent, and this will lead to a further increase in forward speed and loss of altitude, just as during an ordinary spiral. Consequently, forceful operation of the ailerons and rudder is necessary above all.

Thus, if the plane has gotten into a steep spiral, the pilot must reduce engine thrust and, without letting the stick slip forward, drop the speed brakes so that the flying speed and Mach number do not exceed permissible values. Then he must determine if there is any rotation and, if so, in what direction; for this purpose he must check the attitude of the wings with respect to the visible line of the natural horizon and glance towards the side: the outer wing will be slightly higher, and the inner wing, in the direction of which the plane is rotating, will be somewhat below the horizon (during a steep spiral, the horizon is usually visible only from the side of the outer wing, and by this characteristic it is also possible to determine easily the direction of aircraft rotation). After that, he must look at the reading of the AGI-1 and, in a coordinated way, by using the pedal and stick, stop the rotation of the plane around its longitudinal axis — i.e., eliminate the bank (the control surface should be deflected forcefully towards the visible horizon while checking the AGI-1 readings) and, pulling back on the stick, bring the plane out of the dive while keeping an eye on the altitude.

Students are trained in operations in case the craft gets into a deep spiral in the zone at an altitude of no less than 4,000 m, speed of 350 km/hr, and 6,000 - 6,500 rpm. The instructor brings the craft into a spiral with an angle of descent of 50 - 60° and brings it out by pulling back on the stick. At the same time he calls the trainee's attention to the rapid "twisting" of the plane. He then demonstrates how to determine the bank and rotation of the plane and how to bring it out of the steep spiral. After that, regaining the lost altitude by a combat procedure turn or zooming, the instructor gives the trainee the order to determine the attitude of the plane and to bring it out of the spiral. When the students have been trained to operate competently in such circumstances, during subsequent instruction flights into the zone a check must be made which will contribute to consolidating the habits that have been acquired.

EQUIPMENT AND INSTALLATIONS
AND THEIR
OPERATION AND MAINTENANCE

AERIAL ROCKET WEAPONS

Docent, Candidate of Technical Sciences, Engineer Lt. Col. V. I. Marisov

5. Autonomous Missile Control Systems

In order to guide a missile to a target it is necessary first of all to determine the direction and amount of deflection from the trajectory which passes through the target.

The method of carrying out the measurements and the type of measuring devices employed determine the principle of controlling and the method of guiding a missile.

In order to determine the coordinates of a target, every telecontrol or homing system is based on the principle of distinguishing a specific target contrast: radar, thermal, optic, or acoustic. This fact greatly limits the field of application of a missile equipped with a specific telecontrol or homing system. In addition, the coordinate measuring devices have a limited range which, during homing, does not exceed 25 km and, during telecontrol, amounts to approximately 200 - 300 km.

Hitting targets located at a distance of several hundred and even several thousand km is possible only with a missile with a so-called autonomous control. With such a control system, the target coordinates are not measured directly in the course of guidance, but the missile travels in accordance with data programmed on the basis of the missile's position relative to the target at the moment of launching.

The programmed data include a number of values which determine the missile's movement: course, direction of the "launching-target" path and direction of missile axis relative to the horizon, altitude, range, velocity, etc. These parameters are preset in the control system prior to launching.

The autonomous control system with which the missile is equipped continuously reads the actual values and compares them with the programmed data. If there are any discrepancies between the missile's movement parameters and the corresponding programmed data, the control system moves the missile's control surfaces in such a way as to reduce these discrepancies to zero.

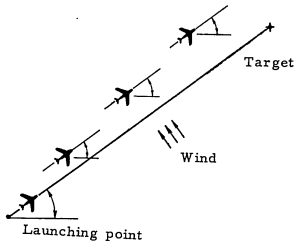


Fig. 1. Drift of pilotless aircraft under effect of crosswind.

Thus the autonomous control system directs the movement of the missile in such a way that the latter travels with preset values (course, altitude, path, etc); and, when the missile reaches a predetermined distance, it puts it into a target dive.

The range is determined by the capabilities of the missile itself, and is not limited by the control system. A highly valuable characteristic of autonomous control systems is their practically complete invulnerability to jamming. This is so due to the absence of lines of contact with the target or the control point. The operation of the autonomous control system is packaged within the missile itself. And, should the enemy detect such a missile, he cannot jam the operation of the system either by camouflaging the target, by setting up decoy targets, or by giving false command signals to the missile.

It should be mentioned that autonomous control systems, as a rule, are structurally more simple than homing and telecontrol systems. But together with their advantages they also have certain inherent shortcomings. The basic shortcoming is that missiles with autonomous control cannot be fired at moving targets because of that same unique feature, namely, the absence of any contact with the target.

Autonomous control systems are divided into gyroscopic, inertial, and astronavigational (there can also be other types), depending upon the method of determining the direction and amount of deviation from the planned trajectory or program.

Gyroscopic systems are analogous to conventional aircraft autopilots. At the mo-

ment of launching the axis of the gyroscope rotor aligns itself with the missile's axis and the missile is aimed at the target. When the missile's axis deviates from the planned heading the rotor axis remains pointing toward the target. An angle is formed between these two axes which is then measured. In accordance with the amount and the sign of this angle, the control surfaces are deflected, the missile turns, and its axis assumes the planned attitude.

The trouble is that, in a crosswind, the missile may shift without changing the position of its axes in space. This results in a wide miss since the control system stabilizes the missile on its course (angular value) and not on the flight path, i.e., the trajectory (Fig. 1). When simple gyroscopic autonomous control systems are used, then, even at comparatively short range (several hundred km), the missile will not only miss a small-scale target, but even a target of greater area (a circumference with 5 - 10 km radius).

The flight path is stabilized in order to reduce dispersion. For the vertical plane this constitutes no difficulty: it is sufficient to introduce a command signal from an altimeter. This signal produces a correction and the missile moves to the desired altitude. However, accuracy in maintaining the desired altitude has little effect on missile dispersion. Of decisive importance here is the lateral stabilization of the trajectory relative to the azimuth.

At present there are two distinct trends in solving the problem of lateral stabilization of the trajectory of an autonomously controlled missile. The first is the use of astronavigational facilities, and the second involves the use of devices for measuring the missile's lateral accelerations.

The essence of the astronavigational method consists in the missile's deriving bearings from the observation of two sufficiently bright stars by means of special devices.

Knowing the position of the target and the point from which the missile was launched, it is possible to preset a definite trajectory for the missile and, consequently, to formulate a principle governing changes in bearing in reference to the selected celestial bodies. This formulation is introduced into the astronavigational system in the form of a program. In flight the measured values are compared with the program values, on the basis of which a command signal is generated.

The use of accelerometers in the system allows us to compute the velocity and also the lateral drift of the missile on the basis of the measured accelerations. As the drift increases, the autopilot receives a correcting command signal and the missile begins to deviate toward the prescribed trajectory, this being also recorded by the accelerometer. As a result, the operation of the entire system is analogous to the operation of an automatic regulating system which reduces to zero the lateral drift of the missile from its prescribed trajectory.

Sextants and accelerometers function essentially as correcting devices just as the altimeter functions as a corrector in stabilization of the trajectory in the vertical plane. The command signals from sextants or accelerometers are transmitted to the missile's autopilot which is, in itself, a gyroscopic autonomous control system. Under the effect of these correction signals, the autopilot turns the missile in the required direction, and the missile's flight path is stabilized.

Let us now discuss in greater detail the autonomous control system.

The basic measuring devices of this autonomous control system are various types of gyroscopes. A gyroscope, as is known, consists of a rapidly rotating symmetrical body (rotor) in cardanic suspension. If the point of intersection of the axes of rotation coincide with the rotor's center of gravity, the gyroscope is called astatic.

Gyroscopic systems.

In order to measure the angular rotation velocities of the platform (in our case the missile is the platform), a gyroscope with two degrees of rotational freedom is used, which is called a two-degree or high-speed gyroscope.

If the rotation of the cardanic suspension gimbal rings of a three-degree gyroscope is limited by elastic connections (springs), then the gyroscope measures simultaneously both angular velocity and angular acceleration, and is called an accelerating high-speed gyroscope. When the rotation of the rotor around the spin axes of the inner and outer gimbal rings of the cardanic suspension is not limited by rigid or elastic couplings, we then have a free three-degree gyroscope. This allows us to measure the spacial angles of orientation of the platform on which the gyroscope is mounted, and therefore it is called a position gyroscope.

How many angular coordinates can a single position gyroscope measure? How large are the maximum angles which it can indicate? And how should the main axis of the gyroscope be oriented with respect to the rotation axes of the platform?

In flight a missile has three degrees of freedom in its rotary motion: around the longitudinal axis (angle of roll); around the lateral axis (angle of pitch); and around the vertical axis (angle of yaw).

Let us assume that a gyroscope is mounted in a missile as shown in Fig. 2a. Since the main axis of the gyroscope is stabilized, the change in the angle of yaw is indicated by arrow 1 on the dial 1', and the pitch angle is indicated by arrow 2 on the dial 2'.

In case the missile rotates about the main axis of the gyroscope, its roll cannot be measured. The gyroscope shown in Fig. 2b measures angles of pitch and roll. These examples show that a single position gyroscope can measure two angles simultaneously. The missile's angle of rotation about the axis which coincides with the main gyroscope axis or an axis parallel to it cannot be measured.

Therefore, in order to measure all the missile's angles of orientation (roll, pitch, and yaw) a minimum of two position gyroscopes should be installed in the missile.

When the angle of pitch increases to 90° (steep dive), the spin axis of the outer gimbal ring (Fig. 2a), which turns with the missile, coincides with the spin axis of the inner gimbal ring. In this way the gyroscope loses one degree of freedom and its operation becomes impossible. When the missile yaws 90°, the main axis of the gyroscope will assume a position parallel to the lateral axis, and any further measurement of the angle of pitch will be precluded.

Let us assume that the missile has pitched less than 90° — for example, 45°. If an angle of yaw is formed in this case, the angle itself will not be measured, but rather its projection on a horizontal surface. On the other hand, with a 45° yaw, only a certain component of the angle of pitch will be measured.

The position gyroscope gives an absolutely accurate measurement of the angles of rotation relative to the axes which are perpendicular to the main axis. This situation requires first of all that the gimbal rings be perpendicular to each other (in our example this is disrupted during pitching) and also that a corresponding position of the platforms

relative to the main axis hold true. Should this condition be disregarded, the angles are measured with so-called cardanic errors. In practice, a position gyroscope normally measures angles of up to $\pm$ 30° from the initial position.

In order to provide for a wide angular range of gyroscope operation, some special instruments have devices which insure that the gyroscope's gimbal rings are perpendicular (gimbal ring correction) and this reduces cardanic errors. Furthermore,

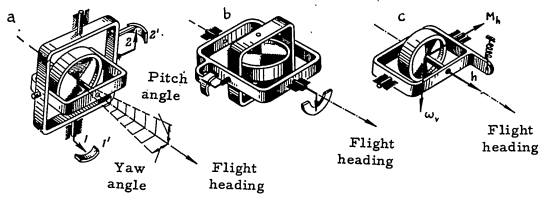


Fig. 2. Installation of gyroscopic sensing elements on guided missiles.

the gyroscope is mounted so as to be movable with respect to the objective.

A two-degree gyroscope (Fig. 2c) is used for measuring the angular velocities of the missile's rotation around the center of gravity. The gyroscope suspension has only one gimbal ring whose rotation is limited by a spring. A missile rotation with angular velocity ω_v produces a gyroscopic moment M_h, proportional to the angular velocity. This moment tilts the gyroscope relative to the gimbal axis; the elastic force of the spring produces a moment which, at a certain angle of rotation of the gimbal ring, balances the gyroscopic moment. Thus, the greater the angular velocity of the missile's rotation, the greater the deflection angle of the gimbal. The deflection is recorded on a dial graduated in units of angular velocity.

A two-degree gyroscope allows measurement of angular velocity with respect to one axis only. Its installation on a missile is determined by the following principle: a two-degree gyroscope measures the angular velocity relative to the spin axis of the lost degree of freedom. In our example, the two-degree gyroscope is installed in such a way that it cannot rotate around the vertical axis with respect to the missile. This will be the axis of the lost degree of freedom.

A problem may arise. Since the gyroscope's axis tends to maintain its position in space, when the missile rotates around the lateral axis (in the given example), the pointer will apparently shift with respect to the dial, and certain false readings will appear. It appears that, when the gyroscope loses one degree of freedom of rotational motion, this results in a loss of stability in its main axis, and the gyroscope, in response to the effect of the elastic coupling, rotates about the lateral axis along with the missile.

The fact is, under the effect of the external moment produced by the spring as a

result of the rotation of the missile, the gyroscope begins to rotate around the gimbal axis. This rotation produces a gyroscopic moment which tends to turn the gyroscope relative to the vertical axis.

But since the gyroscope is not free to do this, there will be no precession. The gyroscopic moment will be balanced by the reactions of the supports (gimbal bearings), and the gyroscope, under the effect of the spring, will turn along with the missile just like an ordinary inertial body.

We will now discuss the arrangement of a simple gyroscopic autonomous control system. The system includes several control channels: for pitch, course, and roll. The layout of any one control channel can be represented schematically as shown in Fig. 3. We will analyze it as it applies to the course channel.

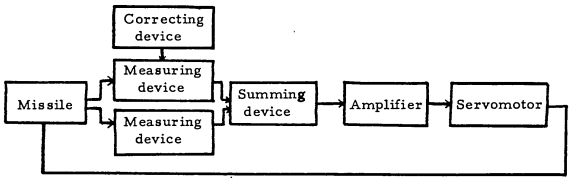


Fig. 3. Layout of one control channel

Let us assume that the programmed course value is 250° for the entire flight of the missile up to the moment it goes into the dive towards the target. In practice the missile is programmed by the appropriate arrangement of the main axis of the position gyroscope which determines the course.

We will assume that, at a certain instant, the missile axis deviates from the target heading and the missile is on a course of, say, 225°; i.e., a 5° discrepancy exists between the missile axis and the main axis of the course gyroscope. The discrepancy signal is picked off the potentiometer and transmitted as a voltage to the summing device. A rather weak signal comes from the measuring device and is amplified after passing through the summing device. After this, the signal is transmitted to the control-surface actuator. The control surface is deflected to the required angle and the missile begins turning around the vertical axis in a direction which tends to reduce the discrepancy. The second measuring device is usually a high-speed gyroscope. The necessity of measuring the angular velocity and the necessity of using this signal to control movement are due to the fact that, when there is no signal from the high-speed gyroscope, the missile will overshoot the position of coincidence, thus creating a discrepancy of opposite sign, and the whole process will be repeated. The signals of the high-speed and position gyroscopes have opposite signs. This is effected by appropriate connection of the potentiometers. Thus, due to the high-speed gyroscope, the discrepancy between the axis of the missile and that of the position gyroscope is smoothly zeroed and the missile will have no oscillatory motion.

The pitch and roll channels function in an analogous manner, the only difference being that a magnetic correction is made in the course channel, and an altimeter correction is made in the pitch channel.

The necessity for correction is explained by the fact that the gyroscope's main axis, in the course of time, "drifts" from the planned heading. This is due to two causes.

First of all, it is impossible to make a three-degree gyroscope with absolutely balanced suspension. In practice the rotor's center of gravity does not coincide with the axes' point of intersection. Consequently, there appears a force of gravity moment relative to the suspension center which is an external moment and causes precession. This moment is usually slight; the rate of precession is negligible; but during a flight which may last several sixths of an hour, the gyroscope "drifts" to a considerable angle. The moment arising from an unbalanced rotor increases if missile accelerations are present. In addition, friction moments in the suspension axes which represent external disturbances must not be excluded.

The second cause of the gyroscope's "drifting" from the planned heading is the diurnal motion of the earth and the missile's motion relative to the earth.

These systems are a combination of simple gyroscopic control systems with an automatic sextant which transmits correction signals to the gyroscopic autopilot when the missile deviates from its planned flight path.

Astronavigational systems

If the gyroscopic system (autopilot) makes it possible for the missile to travel automatically on a planned course, but does not provide for stabilization of the missile's center of gravity along the trajectory, then the astronavigational system, due to astronomical measuring devices (sextants), enables the missile to travel automatically on a planned trajectory. This is explained by the fact that the astronavigational system is equipped with devices which measure the missile's position relative to the earth.

Programming is set up in various ways — for example, by recording on a magnetic tape. The actual coordinates of the missile during the latter's motion are measured with tracking telescopes or radio sextants.

The main difficulty during automatic plotting of a celestial body's angular coordinates lies in establishing the beginning of reading. When operating a hand sextant the navigator uses a level; whereas automatic sextants must be mounted on gyro-stabilized platforms.

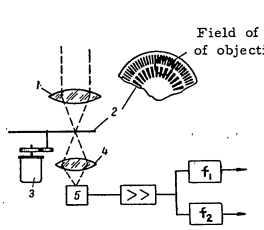


Fig. 4. Simplified diagram of telescopic tracking device.

The gyro-stabilized platform has three degrees of rotational motion and maintains a fixed position with the aid of servomotors which restore the platform to this position on the basis of the signals delivered by the gyroscopes.

A sextant mounted on such a surface has a reliable beginning of reading of the celestial body's angular coordinates regardless of the missile's rotation around the center of gravity.

Actually the coordinates are measured because the telescope is continuously tracking the star. The coordinates are picked off as the telescope's angles of rotation relative to the horizontal (altitude of the celestial body) and vertical (azimuth) axes.

Without further discussion of specific tracking telescope designs, let us examine the simplest possible layout arrangement (Fig. 4).

In the focal plane of the lens (1) there is a disk (2) with slots (light flux modulator) driven by a motor (3).

On the modulating disk there are two rings of alternating transparent and opaque bands, the bands being narrower on the outer rings and wider on the inner ring. When the disk rotates, the light flux is modulated at a high frequency, f_1, if the celestial body's image is above the line that separates the rings, and at a low frequency, f_2, if the image is below the dividing line.

The modulated light flux is focused by the condensing lens (4) and passes on to the photocell. The photocurrent from the output of the photocell is characterized by the signals which alternate with either one or the other frequency, depending on the position of the celestial body relative to the telescope's optical axis. The amplified photocurrent signals are fed into filters, one of which is tuned to the f_1 frequency and the other to the f_2 frequency.

The signal from the filter outpit triggers a motor which turns the telescope so as to align the star's image with the dividing line between the rings. In this case no modulation of the light flux occurs and the signal is zero at the output of both filters.

In order to track on two channels — altitude and azimuth — two half-disk are set up rotated by one motor. The light of flux is modulated alternately by both disks. At the filter output a circuit-breaker is set up, rotating synchronously with the disks and connecting the azimuth and altitude channels at the proper instants.

At the moment of launching, the missile must be so oriented in space that each of the telescopes-set up in advance in the required position — point towards its own star.

However, it is extremely difficult, by mere preliminary setting and sighting, to have the selected stars within the field of view of their respective telescopes. That is why, at the initial moment, the telescopes act as scanners, i.e., the telescope, with the aid of its drive units which assure tracking under normal conditions, swings to the right and to the left along the azimuth with simultaneous change in elevation. As a result the telescope's field of view is, as it were, enlarged, and an area corresponding to 5 - 7° in azimuth and altitude is spanned.

The advantage of astronavigational systems is that dispersion is practically independent of range of fire. Furthermore, they correct errors in determining the point of missile launching, which is of special importance for air-launched missiles. The guidance error of a missile equipped with an astronavigational autonomous control system for a range of 8000 km is approximately 13 km.

The principal measuring device of an inertial autonomous control system is the accelerometer, an instrument which measures accelerations. However, data cannot be used directly. This can be proved in the following manner. Let us assume that the missile is affected by a gust of wind which produces a lateral acceleration. When a signal is generated by the accelerometer the control surface will be deflected, the mis-

sile will have a slip angle, a lateral force will appear which will balance the effect of the gust of wind, and the acceleration will be zeroed. When an accelerometer signal is used, the time of the acceleration effect will equal the time consumed in deflecting the control surface and rotation of the missile to the necessary slip angle. However, after the acceleration disappears, a missile traveling at a constant velocity (without taking into account air resistance) deviates from the planned trajectory.

Inertial systems

Thus, making use of the signal directly from the accelerometer is not expedient. We are interested in zeroing, not the lateral accelerations of the missile, but rather the lateral deviations from the planned trajectory — for which the accelerometer signal must be integrated twice.

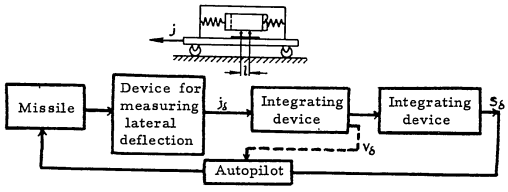


Fig. 5. Layout of an inertial control system (at the top is shown the basis scheme of an accelerometer).

A diagram of an inertial control system is shown in Fig. 5.

A signal, proportional to the lateral drift of the missile, is fed to the autopilot which acts upon the missile's movement. As a result, there is a change in the magnitude of the acceleration fed to the accelerometer. Here, just as during control of the missile's rotational motions where not only an angle signal is used but also an angular velocity signal, the autopilot also is fed a signal which is proportional to the velocity of lateral drift (broken arrow line).

The most widely used acceleration device scheme is an inertial body whose movement is limited by springs. During acceleration of the platform the inertial body, which tends to remain in position, becomes displaced with respect to the instrument frame. This displacement is proportional to the acceleration and is read by the potentiometer.

At the instant when the acceleration of the inertial body equals the platform's acceleration, the inertial body's displacement with respect to the instrument frame will no longer take place,

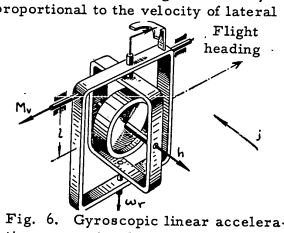


Fig. 6. Gyroscopic linear acceleration measuring device.

since, within equal time intervals, the body and the platform — together with the instrument frame — will be equally displaced.

Besides the inertial accelerometer, for measuring accelerations the so-called "heavy" gyroscope can be used; its center of suspension does not coincide with the center of gravity (Fig. 6). For the sake of simplicity, we will assume that the frame mass is insignificant in comparison with the rotor mass.

During lateral acceleration, j, the gyroscope will be affected by an external moment, the vector of which is directed along the axis of the outer frame facing us. The effect of the external moment produces precessional rotation about the axis of the inner frame with an angular velocity ω_r proportional to the acceleration $\omega_r = kj$.

The voltage picked off the potentiometer is proportional to the angle of rotation. The angle of rotation is the result of the integration of the angular velocity and the time.

If we integrate both parts of the preceding equality, we will obtain the angle of rotation on the left and on the right, as a result of integrating the acceleration, we will have the velocity.

In this way the instrument makes the first integration automatically, and the voltage, proportional to the velocity V_1 of the missile's lateral displacement, is picked off the potentiometer.

The above-described autonomous control systems are in use. The astronavigational system, for example, is installed in long-range air-launched and ground-launched missiles, particularly in intercontinental rockets and pilotless aircraft.

EXPERIENCE OBTAINED IN SERVICING FIGHTER AIRCRAFT FOR NIGHT FLIGHTS

Engineer Lt. Col. G. A. Davydov

Servicing night flights has its own unique and specific features. A certain amount of experience has been accumulated in our unit in the technical operation of highspeed fighters during night flights. This is what we should like to discuss.

Servicing a supersonic aircraft for night flights is organized in much the same way as servicing other types of aircraft: it consists of a preliminary and preflight check. Upon receiving instructions regarding scheduled flights from the commander, the engineer of the unit prepares a servicing schedule in which he makes provisions for the required support facilities (KZ[tank truck unit], APA [aircraft preheating unit], oxygen apparatus, etc.).

The technical personnel assigned to servicing night flights studies the flight line area layout, the airfield traffic lanes, the disposition of the aircraft on the flight line, the setup of receiving procedure after landing, the regulations governing request for special equipment. Furthermore, the personnel studies the takeoff sequence, the personnel stations, and the location of spare parts stores.

The preliminary servicing of the aircraft is done, as a rule, the day before the flights. At that time we inspect the planes and engines and we repair the malfunctions which we spot. Seemingly this work differs very little from that which is done when servicing the aircraft for routine daytime flights. But it also has special features of its own. Thus, electrical specialists check the lighting equipment more carefully; they check the operation of the aircraft navigational lights in three positions of the switch (for 100, 30, and 10%); they examine the glass surfaces for damage as well as the rubber sealing under them. Sometimes at high flight speeds the glass cracks and the rubber seals are sucked out.

An especially careful check is made of the operation of the outside signal system when the landing gear is extended. The fact is that when the plane is flying with extended landing gear, the wiring on the struts vibrates and the wires may be ripped off.

Once one of the electricians, while servicing aircraft for night flights was in progress, switched on the outside signal system and began checking it. While moving a wire on the right-hand mount of one of the machines he discovered that the light went off. It turned out that the negative lead had snapped at the point where it was soldered. The trouble was quickly eliminated.

On another aircraft the outside signal system did not function and the retracted and extended landing-gear position lights did not go on in the pilot's cockpit. Officer N. A. Korneyev established the fact that the positive lead wire on the right-hand mount of the landing gear signal system was broken off. But how could the fact be explained that the lights in the cockpit did not go on? The cause was located. There had been a short circuit which had disconnected the AZS [automatic circuit protection].

These two cases have led us to conclude that, when inspecting the outside landing-gear signal system, it is imperative not only to switch it on, but also to check the electrical wire connections to the mount by moving them about.

In the process of servicing aircraft we also pay special attention to the workability of the taxiing and landing lights. Sometimes it happens that the landing light does not fully retract. But why this happens baffled us for a long time. Group chief, officer S. N. Trusov, established that a malfunction of this type is possible for two reasons, namely, a break in contact in the plug-type connector No. 35 or bridging of contacts in the RP-2 relay.

Now whenever we inspect a landing light we examine the condition of the braces with which the landing light is mounted on the front landing gear strut. The fact is that we have had several cases of brace breakdown. Once mechanic Sgt. V. M. Glastritskiy reported such a defect to officer M. K. Kuznetsov. Upon inspection it was determined that the trouble was caused by a damaged shimmy damper rod.

In inspecting the cockpit lighting fixtures we ascertain that lead connections to the mounts are secure, check the inside illumination lights, the signal system lights, and the condition of the coating (luminescent compound) of the instrument scales and control levers, as well as the correct functioning of the light intensity control device.

Once after a flight the pilot reported that one of the light mounts was going on and off. The light was checked. It lit up normally but whenever the wire was moved it flickered. It was obvious that, due to vibrations and bending when the lights were used, the wire had ripped loose. Checking the cockpit equipment precludes such defects.

In our opinion aircraft equipment should be serviced in the summer in the morning, while the technical personnel should leave for the airfield in order to service night flights about 40 min. prior to their beginning in order to avoid hustle and bustle.

Immediately prior to the flights we once again inspect all the lighting equipment because there have been cases when lights burned out during inspection. All the light mounts are set for night lighting. For the convenience of the flying personnel, in order to shade the signal lights on the landing gear fairing, we make an attachment out of paper with special slits.

In order to reduce glare on the cockpit canopy we fit a blind individually for each pilot. In this way the upper rows of instruments are less shaded and their readings are clearer.

Nor can we disregard such a problem as checking the speed indicator as well as the dynamic and static line. This is particularly important in winter time when the temperature drops and there is the possibility of moisture freezing in the static tubing which, in consequence, will lead to incorrect instrument readings. The dynamic line may clog if the air pressure intake has over it a dirty and defective cover.

There are also special features in servicing the aircraft for a repeat night sortie. When flights start directly from the parking area the aircraft are concentrated in one place and are placed in a row, but at slightly greater intervals than in daytime. This assures safety and reduces unnecessary vehicle traffic.

When the aircraft is taxied to the refueling station, we switch on the aircraft's navigational lights in order to designate the parking area.

We also take into account that the aircraft has a special rod for the air pressure intake, that the engine gives off a rather powerful exhaust stream from its jet nozzle,

and that a strong vacuum is produced in the intake ports. All this demands additional safety measures. Thus, in order to avoid colliding with the rod, we lower it before the pilot climbs into the cockpit, after which we turn on the taxilight and the navigational lights. This shows that the given aircraft has its engines running or about to start.

We must also speak about the aircraft inspection procedure at night. While the technical personnel can see clearly in daylight all the units and assemblies of an aircraft, at night — even under electric lights — these are not too plainly visible. It is difficult, for example, to inspect such assemblies as the landing gear even though they demand more careful checking, since rough landings occur more frequently at night than during the day.

Refueling an aircraft is also inconvenient when the mechanic works with a flashlight. An innovator in our unit, mechanic A. G. Prasolov, has suggested a simple device. He mounted a flashlight bulb on a head gear (on the principle of a miner's lamp). This contraption is very convenient both when refueling and when inspecting an aircraft's units and assemblies.

After the aircraft taxies to the parking area, we cut the engines and check the combustion chambers for the presence of fuel that is still burning. In daylight this is quite plainly noticeable from the smoke and steam emerging from the inlet section and the jet nozzle, but at night it connot be seen. Therefore, after we cut the engines we avoid placing on a cover immediately, and if there is any residual burning we give them a cold start. We also pay attention to the jet nozzle flaps. There are cases when, after the engines are cut, the flaps remain in the position for nominal work regime; this may complicate starting again.

After each flight we check the amount of oil remaining in the fuel-oil system. We have good reason to do this. Thus, once when taxiing to the parking area a pilot noticed that his "No oil" warning light went on. After inspecting the plane, officer N. I. Chistov found that oil consumption was above the norm but that there was no damage in the lines and no leakage. Officer N. V. Borisov carefully inspected the oil system and gave instructions to test the power plant. When the engine was started it was found that at increased rpm the oil leaked out of the drainage line of the bypass web cylinder, because the diaphragm of the centrifugal valve was damaged.

Experience with the technical operation of aircraft at night enables us to conclude that adherence to instructions and directions, a thorough knowledge of aircraft equipment, and skilful organization insure uninterrupted operation of aircraft under any conditions.

SAVING TIME IN REFUELING AN AIRCRAFT

Technician Senior Lt. N. V. Maksimov

Refueling an aircraft is one step in readying it for a repeat sortie; and the faster the aircraft is refueled, the sooner it will be able to take off again.

In our unit frontline bombers and reconnaissance aircraft have been used for a good number of years, and we have a certain amount of experience in refueling them. It must be said that refueling time is not always given due consideration. Usually an aircraft is refueled in a manner as follows. The tank truck pulls up to the right of the

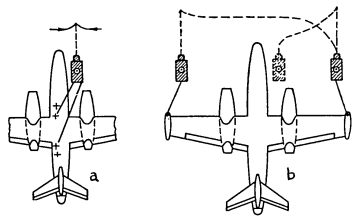


Fig. 1. Aircraft refueling by conventional methods.

nose section of the fuselage and fills the main groups of tanks as shown in Fig. 1a. But occasionally it is necessary to fill the wingtip tanks as well, and in this case the tank truck must make two maneuvers. Additional time is needed to do this and fuel is wasted on the truck's engine (Fig. 1b).

We know that it takes about 10 - 15 min. to refuel one wingtip tank. But how many additional minutes are consumed in dealing with stopping the pumps, winding hoses, and moving the tank truck? If all this time is added up, if one considers too that a good number of refuelings are carried out during a flying day, then one has hours to reckon with and not minutes. Consequently, such a method is far from perfect.

When intensive flight activity is going on in our unit, certain mechanics occasionally proceed in a different manner: they park their tank truck in front of the aircraft's nose about 40 - 70 cm from the navigator's cockpit. In this way refueling time is considerably shortened; but the use of such a method is undesirable since the slightest lack of coordination in the work of the mechanic and the driver may result in damage to the aircraft.

Refueling time may be halved if the tank truck's hoses are lengthened by only 1 m. Then the truck makes one maneuver and fills two tanks at the same time. In so doing,

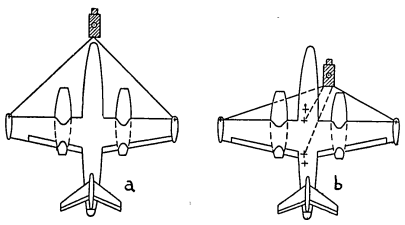


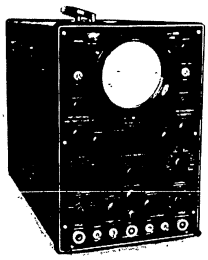
Fig. 2. Refueling with lengthened K 2 hose.

maximum pump output is used, i.e., the highest permissible pressure at the filter and in the hoses (Fig. 2 a). Another version allows all the tank groups of an aircraft to be refueled from one position of the KZ [heavy tank truck]; but in this case one of the hoses must reach the left wingtip tank (Fig. 2 b).

By halving the refueling time, we enter a correction in the schedule table for the flying day and keep the aircraft in the air longer. This allows us to increase the time in the air for each aircraft — without altering the amount of starting time — and to raise the combat-readiness level of the whole unit.

CATHODE RAY OSCILLOGRAPH

By using the ENO-1 oscillograph it is possible to observe the waveform of low-frequency electrical oscillations and also to examine the waveform and to meter the basic parameters of pulses of long duration. The ENO-1 replaces the obsolete apparatus of the EO-7 and 304-I type.



The vertical beam deflection amplifier is a broad band unit with an irregular frequency response of 3 db.

The oscillograph has two types of sweeps: a continuous sweep and a slave sweep with a wide range of subbands.

Sweep synchronization is accomplished either by using the test signal or one from an external source.

In the instrument there is a means for actuating the slave sweep — a pulse generator which delivers to the external output a pulse which had been delayed with respect to the start of the sweep. The amplitude of the delayed pulse changes evenly from 5 to 50 V. with

a load of 10,000 ohms. Delay time is regulated unevenly.

The apparatus provides for measuring with sufficient accuracy the amplitude of test signals from 0.05 to 250 volts.

There is provision in the oscillograph for modulating the intensity of the beam by using an external signal.

FROM THE HISTORY OF SOVIET AVIATION

COMMUNISTS ARE CLOSER TO ME THAN ANYONE

I. U. Pavlov

From the very first days of the Great October Socialist Revolution, Military Pilot I. U. Pavlov appeared with weapon in hand to defend its achievements. He formed the first Soviet air group, commanded it skillfully, and himself carried out dozens of combat sorties. For bravery and heroism displayed during battles with enemies during the years of the Civil War, I. U. Pavlov was awarded three Orders of the Red Banner.

In due course a book written by I. U. Pavlov was published posthumously, in which the author gave a brief account of the combat feats of Soviet pilots during the years of the Civil War. Now one of the versions of his manuscript has been discovered. Below we give an abridged excerpt from this manuscript in which the author tells about the unforgettable days of the birth of the Soviet Air Force, and about the defense of the achievements of October.

The Fall of 1917 was beginning. Our air group was located approximately thirty-five kilometers from the front, in the village of Kovalevka. This was a completely solitary spot where for weeks on end not a single person would turn up from the front. Nevertheless, exciting news kept seeping through to us. A considerable element of tension was felt within the Army and throughout the entire country. An obvious watchfulness and a sharp estrangement in the relations between soldier and officer were obvious. The air group had regularly conducted combat work right up to the retreat of the armies of the Southwestern Front to the Zbruch River and the transfer of the group to the small town of Dunayevtsy in the province of Kamenets-Podol'sk. There was no political propaganda in the air group, and indeed this was understandable: for its combat work it was considered to be the most illustrious group in the Tsarist Army and it was a unique sort of air guard with the toughest pilot personnel. There is no doubt that there were many arrant members of the Black Hundred [an ultra-reactionary group] here.

The news reaching us had a telling effect on the morale of our unit. Frightful drunkenness flared up among the officers.

No one, of course, does any flying nor does anyone have any intention of doing so. Group Commander Kazakov is not heard from at all. He doesn't even show himself in public. There is a feeling that a dreadful time is approaching. Something must be done. But from casual conversations and encounters it is impossible to find out a thing. Under guise of a leave, I decided to get to Kiev and there orient myself as to the situation.

On the very second day after my arrival in Kiev, I started going to all kinds of gatherings and meetings. Among the railroad workers at the depot, among the arsenal workers, on the streets — everywhere there were meetings and gatherings. I was carried away by the clarity and persuasiveness that distinguished the Bolshevist orators. Furthermore, these were men to whom I felt close in blood and spirit — workers and soldiers exhausted by the war. During those days, I read scores of leaflets, appeals, and newspapers in which extensive clarification was given as to the meaning of Soviet power, the dictatorship of the proletariat, and proletarian revolution. More than once I attended gatherings of a different type where other forces operated — the forces of the counterrevolution. The Bolshevik slogans and appeals became all the more significant and convincing. It became clear to me that among the officials and hucksters, and among the upper and petty bourgeoisie there reigned a blind fear of losing their privileges — and this meant, in the first instance, the Bolsheviks.

But I had scarcely managed to look around and to organize and somehow to examine the thoughts raging within me when my leave drew to a close and I had to leave Kiev. Upon returning to my group by 1 October, I found the same savage drunkenness there as before.

Kazakov kept aloof and did not take part in this dissipated company. He apparently harbored within him the thought of how best to revenge himself upon the "ignorant brutes" for their mutinies. At the same time I became completely convinced that in the event of decisive operations we would easily succeed in dealing with these wearers of gold epaulettes.

The news about the events of October in Petrograd and Moscow was unexpected for us. None of the men in our group was able to report anything of how these events had unfolded. Nothing definite could be found out even through the workers and activists of the local textile factory whom I met almost every day. Nevertheless we decided to be ready in the course of thirty to forty minutes to sabotage our entire equipment— aircraft, engines, and machineguns — in the event the officer-pilots became involved in counterrevolutionary action. This question was thrashed out thoroughly several times at restricted conferences with the engine mechanics. We made a plan to handle the matter in such a way that the officers would not be able to suspect it — namely, one part of the aircraft was to be kept in such condition that takeoff from the airfield would be impossible altogether; another part in such condition that the engines could be started up, but, once tested at high speed prior to takeoff, would fail immediately; and a third part (for the most inveterate counterrevolutionaries), in such condition that the aircraft, after having taken off, would crash after ten to fifteen minutes of flying.

Someone suggested that we steal up to the tents at night and burn up all the equipment. I objected categorically to that measure both as a pilot (the best aircraft in the entire Tsarist Air Force were in Kazakov's group) and because of the fact that somehow I felt instinctively that these weapons would yet prove useful to us.

Order No. 1 appeared concerning the removal of epaulettes and the abolition of officer privileges. Commanders became elective.

It turned out that there were only two candidates for the office of commander: Kazakov and I. As a result of the voting, the majority remained with me. I became the democratic commander of an Air Force group of the armies of the Southwestern Front.

Tremendous responsibility devolved upon me. As my first order, I demanded that those officers who had not yet removed their epaulettes do so at once. I banned

the issuance of alcohol to anyone whatsoever without my personal authorization. I began introducing order in the performance of guard duty in the garrison.

I had to go to the Seventh Army Revolutionary Committee in Proskurov in order to obtain the necessary instructions concerning my rights and duties and to find out what else should be done with the group. By that time the pilot-officers had virtually fled. They were leaving quietly, alone, usually at night.

Except for me, there remained only one pilot, Morkovnikov, a very young soldier. He had been in the group for only two or three weeks, was living like some sort of a groundhog at the edge of town, and did not appear anywhere. He was not interested in anything, it seemed; whereas during those days it was hardly possible to find a person who could gaze with complete calm and impassivity at the events which were unfolding.

The question of nationality had taken on exceptional sharpness among us in the group. The main bulk in the group was made up of Russians, followed by Ukrainians and Caucasians. At meetings all clamored unanimously that all the aircraft had to be divided up equally among the national groups. My Ukrainian fellow-countrymen put the question pointblank. They announced that if they were not given their rightful share of the planes they would pour gasoline over them and burn them before the eyes of all — "so's no one should feel hurt". The quarrel went on in such a spirit for almost an entire evening. My speech proved to be decisive. I told of the danger threatening the revolution and of the necessity for uniting the peoples of all nationalities for the struggle against the bourgeoisie.

Something practical had to be suggested, and I concluded: "Comrades, until there is a decision by the Seventh Army Revolutionary Committee, there can be no sharing of aircraft. We must all of us do everything possible to leave here directly for Moscow with the planes and there place them and ourselves at the disposal of the Revolutionary Government. And if it tells us to share the planes among ourselves and go home, then there'll no longer be anything for us to argue about. But until that happens, we must keep firmly in mind that our enemies are not asleep. Tomorrow I'll go to Proskurov and take all steps for us to be evacuated a little faster to Moscow."

Towards the end of the meeting, two workers arrived, members of the local Municipal Soviet. They gave decisive support to my proposal.

Early in the morning on 30 November I left by car for Proskurov. After attending to matters and taking along about a pood and half [60 pounds] of all kinds of literature, I hurried back.

On the evening of that day we had a conference in the Soviet. There was one question on the agenda on intensifying the revolutionary vigilance and combat readiness of the garrison. After the conference, all my friends — most of them already Bolsheviks — started to say to me with one voice: "Well, Pavlov, now you've joined up with us in a reliable way — or as the saying goes, intimately — in the struggle for the revolutionary cause. You're a good pilot and comrade. Tomorrow the revolution will without fail need loyal pilots. So here's the story. You think it over carefully, and give us an answer tomorrow. It's time for you to stop going around among us as a non-Party man. If you join the Party our cause will be stronger and your work will be easier. And as far as sponsors are concerned, don't worry".

I fell to thinking very seriously about this question. The Bolsheviks are following the teachings of Marx, Engels, and Lenin. They have a program and statutes. I know about this only through hearsay but I feel that they are closer and more akin to me

than others. I made my decision — I'll become a Communist-Bolshevik, I'll devote myself completely and without reservation to those honest men, deeply loyal to the revolution, who are inviting me to join them.

The formal aspect of the matter was very simple. I had only to write my autobiography. On 2 December 1917 I joined the revolution — now as a Bolshevik. From that day on a new youth began for me, with new storms and joys.

We continue besieging the Seventh Army Revolutionary Committee and even Moscow with requests for the speediest evacuation of our air group, since otherwise we will end up in a situation where no men will remain to disassemble the aircraft and load them onto the flat cars. Flight from the front is constantly on the increase. Nothing can be done against the desire to return home a little sooner.

Finally, information was received at the Revolutionary Committee that Nikolay Vasil'yev, a representative from Moscow who had been appointed chief of the Air Force in the Ukraine, had arrived in Kiev, and that consequently we now had to address ourselves directly to him.

February 1918 arrived. We received intelligence that to the north of our army the Germans advanced and were conducting an offensive against Kiev. Under their protection, the village kulaks were organizing Haydamak [Ukrainian counter-revolutionary cavalry] detachments as a battle bulwark for the Ukrainian bourgeois Rada [Ukrainian parliament]. With the capture of Kiev, we might be left in the rear with the Germans and the Haydamaks. We quickly load a freight car with gasoline and spare parts for aircraft and engines, send along three engine mechanics with them, and dispatch all swiftly to Kiev. A day later, I leave for the same place in my aircraft, with a stop-off landing at Zhmerinka where the Sixth Air Force Supply Depot was stationed. Here I was told that Comrade Vasil'yev, the present chief of the Air Force in the Ukraine, was a former worker at the Sixth Air Force Supply Depot, an engine fitter by specialty. That made me very happy. In four or five hours I land in Kiev at the Volynskiy station. It was muddy. After fruitless attempts to find out where the chief of the Air Force in the Ukraine was located, I walked around my plane and tried to figure out what I should do. Who was an enemy here and who a friend? At that time a light "Fiat" bursts onto the airfield completely enveloped in smoke. The car stops not far from me, a man jumps out of it quickly, comes straight towards me and while walking flings a question at me: "Comrade, are you the one who just flew in? Who are you and where are you from?"

At first glance I determine that he is one of us. I gave my name and asked whether he couldn't point out to me where Comrade Vasil'yev, the Air Force commander, was located.

"I'm Vasil'yev", he answered.

Before me stood a man with light brown hair, tall, with pleasant features, in old torn boots and the same kind of overcoat. A dark blue coloration was noticeable beneath his eyes, indicating that he had not rested for a long time. By his face, his conversation, and his movements, it was evident that he was an energetic and restless person.

It was here that we started to become acquainted with the situation. Vasil'yev pulled a map out of his pocket and informed me that by tonight our troops would have to surrender the Fastov station. It was possible that German troop trains were already approaching the station. It was necessary to fly there, find out what was going on, and

drop a few bombs on a troop train.

In twenty minutes I had obtained gasoline and Comrade Vasil'yev had brought five ten-pound bombs from somewhere. During the course of an hour I carried out my mission and returned to the airfield. Vasil'yev was awaiting my return. Unusually joyful and gay, he took me down to the hotel and he himself went off to the Revolutionary Committee.

When Vasil'yev returned I told him about our situation, started to ask insistently for help, and I got ready to fly back to Dunayevtsy. But Vasil'yev explained the situation to me and ordered me to remain at his disposal in Kiev until it would be possible to commence the evacuation of the air group. During this time I would have to conduct air reconnaissance in the Kiev area every day. He would send a wire to the Seventh Army Revolutionary Committee and to Moscow with regard to the fact that I had been detained here.

Thus I remained in Kiev, where,to my great joy, the freight car with the equipment and the engine mechanics had already arrived. It had successfully slipped by the Fastov station which had right after that been occupied by German recon troops.

Under pressure by the Germans, we were forced to leave Kiev. Vasil'yev ordered that the freight car with the equipment be dispatched to Nezhin, and I, selecting airfields at my own discretion, had to move, maintaining contact with the Red Guard Detachments of Kikvidze and Chudnovskiy. Vasil'yev himself remained in Kiev for illegal Party work. The encounter with him played an important role in my development as a Bolshevik. His conversations on various political topics, his warm, comradely attitude, and his great confidence quickly drew us close to each other, and while still in Kiev we made a close combat alliance.

While carrying on combat work with the Red Guard Detachments which had left Kiev I was not able to go far away from them. I usually chose landing surfaces in the following way: knowing full well at what station the headquarters of my Commander in Chief was located (operations were being conducted chiefly along the Kiev-Poltava main RR line), I would look closely at the surrounding terrain and I would settle down on the first clearing I ran across.

My engine mechanic Ilyusha Ivanov (he was also chief of liaison with higher troop headquarters, chief of supply, and my headquarters commandant) would quickly appear at the landing site and inform me about the latest events at the front and about the mood of the local population.

We were always received warmly in the units, all conveniences set up for accommodating and feeding us, and — the main thing — they considered us as their own pilots and liked us. In cases where our units would get into difficulty, I would make a sortie to drop a couple of bombs on the Haydamaks and the Germans, fire my machine-gun at them, and afterwards roll a few times over the heads of our troops. The Red Guardsmen saw me run down a German a couple of times who had been dropping bombs on our men and who did not show up for a very long time after that. This circumstance was a very good indication of the fact that the Germans were after all rather afraid of us. Many of the commanders and Red Guardsmen who appeared at detachment headquarters made it a rule for themselves to see their pilot without fail and confirm their friendship for him.

Near Mirgorod the gasoline and castor oil supplies were already beginning to give out. The fiercest dogfights had started up and the situation required more sorties. Out

of the fifty poods of gasoline which I had taken along there remained only eight to ten, and about two poods of castor oil. But these two had been driven off to Poltava together with the freight car. What was to be done? The situation was such that about all one could do was to burn the plane. I reported this to Kikvidze when he came galloping up to the plane on a dashing horse at the Romodan Station (Ilyusha and I were together occupied with some minor repair work on the plane).

"That's no calamity, comrade pilot. We'll get you some petroleum and fuel oil right away, as much as you want. Will she fly on that?" — he pointed to the plane with his hand.

"No, she won't, Comrade Kikvidze. You see, she's a very noble and capricious creature, she loves only high-grade gasoline and castor oil, and doesn't use anything else."

"And if we threaten your bourgeois lady with execution, perhaps she'll agree to petroleum and mazut?" asked Kikvidze, smilingly.

I sincerely liked this fearless man. For me he was the living embodiment of the revolutionary heroic spirit. During the most dangerous moments of battles, when the Red Guard units, surrounded on all sides, were threatened with destruction, Kikvidze would appear among the soldiers, who had already lost all hope of being saved, as though he had sprung up out of the ground, and by his very presence alone would raise the men's combat morale. They would fight like lions and usually win. I didn't feel like distressing this remarkable man, but still I repeated: "Comrade Kikvidze, without gasoline and castor oil, it's impossible to take off."

At that time, the orderly who was accompanying Kikvidze, a Petrograd worker, all wrapped around with machinegun cartridge belts, somehow changed countenance, as though he had recalled some joyous event in his life. Interrupting me, he reports to Kikvidze: "Comrade commander, I'll get both gasoline and castor oil within an hour. I know where they're to be found. Allow me to request them in your name."

"Wait a minute, wait a minute!" First tell me, who's hiding these supplies?"

"We'll requisition all the gasoline and castor oil in the pharmacies, where they are always to be found."

That was a clever idea and it made me very happy. It made Kikvidze even happier. He ordered a dozen or so soldiers to be outfitted on carts and that they at once make the rounds of all the local pharmacies and confiscate the supplies of gasoline and castor oil there, and further that they should deliver it all at my request which I was to hand in to his headquarters in advance.

In two hours three poods of gasoline and twenty pounds of castor oil were delivered to me. We at once refueled the plane and in ten minutes, after rocking slightly on the poorly surfaced field, it took off into the sky taking with it three ten-pound bombs. I knew with what toil the gasoline and castor oil had been obtained, I understood fully well how important my work was right now, and consequently I tried my best to drop all three bombs exactly on the heads of the Haydamaks and Germans. Not one fragment missed the target. In such cases I always dived low, with the engine running, onto the enemy group and, levelling off at a hundred meters from the ground, would drop the bombs. The hit was faultless.

When we had been pressed back towards Mirgorod, there were several heavy spring rains. There was impassable mud everywhere. Ilyusha Ivanov and I set up our headquarters in one of the small huts at the very edge of the city. In the same spot

we also placed our aircraft, fastened to the rear wall of the hut. It was late evening. Above us stretched a clear starry sky. There was a slight frost. Sitting in the hut, we were carrying on a conversation about how we would get to Moscow, tidy up, and set off again to fight— not the same way as now, but in an organized manner, as part of a whole unit.

Someone knocked at the little window of our hut. By his voice I recognized that it was Nikolay Vasil'yev. More than two weeks had gone by since we had parted. All this time he had been conducting illegal work, carrying out the most dangerous assignments of the Party. It was obvious to me how tired he was. After supper we started up a conversation about the fact that in the event Poltava was surrendered, we would move to Moscow, in order, after organizing ourselves there, to return to the front again, to a place where our work would be the most useful.

Vasil'yev, who understood better than I the ridiculousness of our position, agreed with me. But he was always drawn to places where it was most dangerous. In telling me about his underground work, he would become so carried away, his eyes would flame up to such an extent that it seemed he was on the verge of catching on fire from the fire raging within him.

From everything that surrounded us, it was becoming clear that the forces of the revolution were still insufficiently organized in a military respect. The Germans were slowly but surely pushing us out of the Ukraine, and we, while retreating, were contracting ourselves, as it were, in order to take a jump afterwards which would smash our present conquerors to death. I was still comparatively young, could fight rather well, and somehow I felt deep down that there was nothing to show off about, nothing which I could point out to my combat friends to show what my weapon and the man who could wield it skillfully were worth in combat. My solitude in combat weighed heavily on me, in spite of the fact that I did everything to help the small groups of heroes who were fighting up front. Still, it was clear that the forces of the revolution would swiftly become organized and that we would again move forward. But, where were these forces? Nikolay always told me that they were in Moscow. Only in Moscow would we find the pilots, the planes, and everything necessary to crush the enemy.

FROM ORDER NO. 529 OF THE
REVOLUTIONARY WAR COMMITTEE OF THE REPUBLIC
9 November 1920

The Order of the Red Banner is herewith awarded for the second time to:

Assistant Chief of the Southwestern Front Air Fleet, Red Military Pilot Comrade Ivan Ul'yanovich Pavlov because, during the offensive by our troops in the Thirteenth Army area...he, while leading group flights, organized these flights so well that in the course of a month the group chalking up as much as 500 flying hours and 200 poods of bombs dropped, was able to furnish exceptionally valuable information about the enemy. In spotting groups of large enemy combat units, the Red military pilots would carry out flights at minimum altitude and more than once scattered a concentration of White troops with bombs and machinegun fire. In this work, Comrade Pavlov, by his energy, intrepidity, and bravery, aroused his comrades to carry out flights in any kind of weather, and at any time of day and night.

READERS SUGGEST

A NEW TOWING DEVICE

The towing gear in existence at the present time — or, as it is customarily called, the "hitch" — is a very bulky and heavy device. In addition it is not standardized: every type of aircraft must have its own gear, adapted to a definite wheel base of the aircraft landing gear. This creates a number of difficulties during the landing of aircraft of other types on the airfield, or in moving the aircraft unit to a different base. Transportation of towing devices from one airfield to another requires additional transportation facilities. When flights are in progress on the field they seriously jam the starting line, the taxiway of the runway and obstruct the movement of trucks, especially at night.

A reader of our journal, Engineer Lt. V. V. Koryakin reports that an innovator in his unit, officer I. F. Galanin, has proposed a new design for the towing device, different in principle from the old one.

The greatest advantage of the proposed device is the fact that it is an integral part of the GAZ-153 tow truck and thus is eliminated from the equipment of the aircraft.

Such a hitch consists of three principal parts: the wheel fork, the guide pipe, and the power pulley assembly. The wheel fork (1) has a pintle for attaching to the axle of the front strut of the aircraft landing gear (Fig. 1). Its dimensions and form are the same as those of the former hitch. A shank-like gusset plate is welded to the front end of the fork, at the end of which is located an opening for the bolt (2) which connects the fork to the body of the retainer, the guide pipe, and the slot for the tooth of the spring retainer. The swivel joint is necessary here to make it possible for the tow truck to approach the aircraft at any angle within 180°. This makes it possible to couple the fork to the wheel axis on the first approach of the truck tractor. The retainer keeps the guide pipe accurately perpendicular to the wheel axis in the process of towing the aircraft. A channel bar is welded across the top of the gusset plate and to its ends are attached shackles with guiding pulleys. The design of the shackles is such that the pulley has three positions of free movement. This gives the wire cable a considerable degree of protection from wear. The gusset plate and bar together provide the required rigidity for the fork assembly.

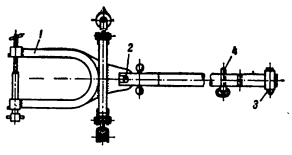


Fig. 1. The wheel fork with guide pipe of the towing device.

The body of the retainer is mounted on the guide pipe (the pipe is slid over the body and is then welded at the junction). In front of this an arresting ring (3) is fastened with the aid of a through bolt which prevents the guide pipe from slipping backwards out of the clamp. Two horizontal holes are drilled in the pipe perpendicular to its axis for a ringbolt (4) to prevent the aircraft from coming up against the tow truck (two holes are made for two types of aircraft with different wheel base).

The assembly of the power pulley (5) and of the thrust guide clamp (6) of the towing device is fastened by four tie bolts to the rear cross bar of the tow truck frame (Fig. 2). The assembly consists of two plates, a bracket (7), the power pulley, and a thrust clamp. The clamp is fastened to the upper plate and the bracket by trunnions. The power pulley is free to rotate on the lower trunnion of the clamp. In mounting the assembly on the frame of the truck tractor, the bumper brackets are shifted 180° and the truck tractor hook is turned 90° (or is completely removed).

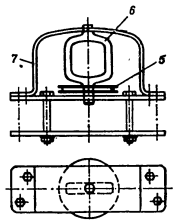


Fig. 2. Power pulley and thrust clamp assembly (mounted on frame of the truck).

The towing pull is transmitted from the truck tractor to the aircraft by a chain, the cross bar of the truck tractor, the plates and brackets, clamp, power pulley, towing cable, and main landing gear struts of the aircraft. The guide pipe and the wheel fork of the hitch do not transmit any pull.

In the idle position the hitch is located under the body of the tow truck on its frame. The body is free and can be used for any other purpose.

Officer Koryakin's outfit has been carrying out combat training work for a long time with the use of the new towing device and there was no disruption of scheduled flights during all this time.

However in Koryakin's opinion, the design of the wheel fork lock should be modified in such a way as to enable the mechanic to remove the fork from the lock and move it to the wheel axis. This was not always possible.

It is desirable that no great effort be required to separate the fork from the lock and that the lever of the lock be convenient and durable. In operation the following characteristics of the hitch were observed. For instance, when the truck tractor approaches the aircraft at an angle of 20-30 degrees the hitch fork, after it has been fastened to the wheel axis, does not rest on the lock and remains so during the first moment of taxiing. No force sufficient for turning the front wheel of the aircraft's landing gear is applied to the guide pulley and the danger arises that the aircraft will move in a large circle.

To avoid this, the wheel must be lightly braked in the direction of the desired turn; this is done only in the first moment of taxiing until the fork moves to the lock.

The device described above still requires a great deal of work, but its concept is rather interesting.

LAP PLOTTING BOARD

The qualities of lap plotting boards in existence do not satisfy the flying personnel. The pilot must have data on the operation of ZOS [ground navigational aid] facilities of the home and alternate airfields, on radio communications, etc. They all must be arranged in such a way that they can easily be found and read; otherwise the pilot, occupied with flying the plane, especially at night or under adverse weather conditions, will not be able to use them.

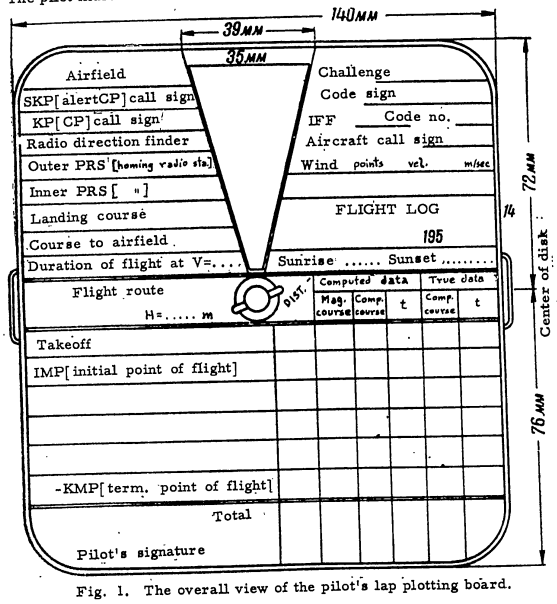


Fig. 1. The overall view of the pilot's lap plotting board.

Military Pilot First Class Lt. Col. A. M. Kobyakov has devised a new model of the lap plotting board, a drawing of which is shown here. It consists of an outer part,

made of white opaque celluloid 1 mm thick (see Fig. 1); a revolving disk of the same material (see Fig. 2); a steel or duraluminum holder 1 mm thick which fastens together the assembled outer part and disk; support plates (brackets) of celluloid 1.5 mm thick (attached to the bottom of the outer part of the blotting board) or of duraluminum (attached to the holder) designed to prevent binding of the revolving disk; brackets of wire 2.5 mm in diameter for attaching a belt or a rubber band.

The use of such a plotting board enables the pilot to find the necessary flight data easily.

If the plotting board is illuminated by "UFO" [ultraviolet light] bulbs, notes made on it can be read even during night flights.

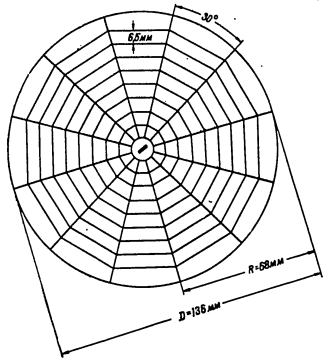


Fig. 2. Drawing of the revolving disk of the pilot's lap plotting board.

[This drawing is one half size of the preceeding]

FROM THE EDITOR'S MAIL

The reader continues the discussion

"BEARING" IS THE BEST COMBAT FORMATION

The letter from Engineer Maj. A. M. Mikhaylov, "Front or Bearing?" published in the issue No. 5 of "Herald of the Air Fleet" has caused animated discussions among officers.

We are in complete agreement with the author on the point that the "front" combat formation of a pair for aerial target sweep is inefficient and that "bearing" is the most suitable method for this purpose. The advantages of the latter have been aptly pointed out. We would just like to bolster the arguments in its favor.

It is well known that, in flights at speeds close to maximum and at high altitudes, maintaining one's position in combat formation becomes difficult. It is clear that the thrust reserve of the engine decreases with increasing velocity; also, the greater the altitude, the more sluggish is the aircraft. This fact may lead to an uncontrolled closing in on the leader, force the pilot to check his position more frequently, and, consequently, devote less time to the sweep.

Besides, it is easier for the pilot to maintain distance than interval. Therefore it is less dangerous for the wingman in a pair to be at some distance from the leader. Even when the interval suddenly decreases to zero, the danger of collision can be avoided and the pilot has considerably more freedom; hence, he carries out the sweep much better.

The wingman, who is in a position to change the interval to zero at any time, can carry out curvilinear maneuvers with a radius equal to that of the leader without losing sight of him. This increases the maneuverability and the combat potential of the pair.

In the "front" combat formation the maneuver is more rigid and less safe, since the pair must bank by the "all at one" or "one after the other" method. In banking by the first method the wingmen frequently lose their leader temporarily from the field of vision. On banks of less than 90° a greater reserve of engine thrust is necessary to maintain one's position than that needed by the leader. But since thrust reserve diminishes in flight at high speeds, it is possible that the wingman will not have enough and will drop back, forcing the leader to reduce speed.

In our opinion, the "front" combat formation is more defensive than offensive. At low flight speeds, when the main task of the wingman was to cover the leader during an attack, the formation was justified. In jet aircraft, the wingman is capable of carrying out this task only by dropping back considerably or by moving aside. But then the combat formation is disrupted.

Besides, the tasks of the wingman have now changed and multiplied. He takes part in the attack together with the leader. And such an attack is less dangerous and more effective in combat formations extended in depth and narrow in front. This is the reason why "bearing" lends itself more to offensive action.

Lt. Col. D. F. Goldyrev

Review of the Readers' Mail

CONCERNING THE INFORMATION GAINED FROM EXPERIENCE IN OPERATING GLIDER TARGETS

Our journal published articles in issues No. 6 and No. 11 for 1956 and No. 3 for 1957 summing up experience in operating aerial glider targets and tow equipment: N. P. Marchukov, "Utilization of Aerial Targets", N. S. Veligin "Repair and Maintenance of Targets on the Ground", S. G. Sheludchenko, "Lifting the Target with the Rigid Coupling" and V. N. Sandulov "On the Winch Braking Clutch".

In response to these articles many officers enter into discussions with the authors, tell of the experience in their work, write about the creative efforts of innovators, make proposals and suggestions on the improvement of methods of maintenance of glider target and elimination of design and production shortcomings.

Officer G. Y. Lebedev reports in his letter that in his unit they use a method of painting the heads of the shells different colors beforehand (a certain color is assigned to each gunner) to determine the individual fire results for each pilot in group gunnery practice when using the same target.

Furthermore, to retain the traces of paint on the target and to prevent the latter's disintegration in flight from breaks and cracks, the unit's innovators have proposed that a cover of ADO linen be glued over the target and its extremities (or wingtips) be painted black or red to indicate contours.

As a result, the life of the targets was prolonged 2-3 times. Now, even with a large number of hits the ADO material protects the glider from disintegration. With the application of enamel paints of different colors to the ammunition, six pilots can shoot at the target in one run.

Officer V. A. Gun'ko tells in his letter of the difficulties met by the engineering and maintenance personnel of their unit in operating glider targets. For instance, he analyzes in detail a case when the one-way clutch of the winch friction brake failed. This is how it happened. When the target is rigged on a six-roller rigid coupling, at first only two of the rollers engaged and took all of the load. As a result, the rollers were deformed, and this led to an uncontrolled reeling of the tow cable when the electric motor of the winch stopped.

Officer Gun'ko does not confine himself to the description of this failure but proposes methods for its prevention. Deformation of the rollers of the one-way clutch and its faulty operation can be determined by testing the winch on the ground. With faulty coupling of the rollers of the one-way clutch, when the target is rigged on a rigid coupling, the tow arm moves back 10-15 cm and sometimes returns to the catch. The malfunctioning of the one-way clutch roller coupling can be determined even with the friction brake removed from the winch. It is necessary to grasp the clutch body with one hand, grasp the gear with the other, and turn the latter this way and that. If the gear slips in the payout direction, the normal coupling of the rollers is defective. In such cases Gun'ko recommends that the friction brake be removed from the winch, the one-way clutch be forced out, the coupling rollers, their pins and springs be inspected, the

necessary repairs be made and the grease changed.

When the target is towed, the cam of the carriage sometimes disengages from the screw of the cable drum due to the loosening of the lock nut. To eliminate this defect it is suggested to drill holes in the carriage body and in the end nut of the cam catch for additional locking with soft wires.

Officer V. V. Semin reports that a great deal of time was spent in his unit on changing the cable. The cable was wound onto a hand winch and then, after removal of protective coating, onto the tow-truck winch. To speed up this time-consuming operation a horse with planking was constructed in their unit. Com. Semin also relates that in lifting the target off the ground its wingtips are often broken. To avoid this they have reinforced the wingtips with plate braces. But such modification was accompanied by a new complication, namely extensive vibrations of the wingtips. But here a solution was also found. In order to eliminate vibrations T-braces were used and rubber pads were inserted under the bolts.

Good organization of operation and repair of targets allows for prolonging their useful life and increasing the reliability of the tow equipment.

REVIEW AND PUBLICATIONS

A NEW TEXTBOOK ON AIRCRAFT AERODYNAMICS

I. V. Ostoslavskiy "Aircraft Aerodynamics". Oberongiz Moscow, 1957. 560 pp. Price 15 rubles 50 kopeks.

A new textbook by Professor I. V. Ostoslavskiy has appeared in print under the title "Aircraft Aerodynamics". It gives a comprehensive treatment of all subjects included in a course on flight dynamics: aerodynamic design, elements of dynamics in which unsteady and curvilinear motions are treated, as well as flight at greater than critical angles, spin, and longitudinal and lateral stability of the aircraft.

The text is the result, as is mentioned in the preface, of many years of experience in teaching on the part of the author at the Moscow Institute of Aviation. Materials from the books "Aerodynamic Aircraft Design" and "Longitudinal Stability and Controllability of the Aircraft" written by I. V. Ostoslavskiy in collaboration with V. M. Titov (the first text) and G. S. Kalachev (the second) are used in the book. We assume that these books are widely known to the reader of books on aviation. It is stated in the preface that the main sections of the course must be presented in a definite sequence with a unified methodology. The author points out that "...this book is an attempt to create a text which satisfies these requirements".

Without minimizing the difficulties in writing a comprehensive treatment of such a difficult course, we must mention, however, that this attempt is not the first one. In 1943 a text by V. S. Pyshnov was published under the title "Aircraft Aerodynamics" in which the main branches of the discipline were also presented comprehensively.

It is quite clear that the book by I. V. Ostoslavskiy represents an important event in the life of aeronautical institutions of higher learning. I. V. Ostoslavskiy is not only an excellent pedagogue, but an exceptional research scientist who has devoted a considerable share of his efforts to the post-war development of our jet aircraft. In our review, however, we would like to devote most of the space to critical remarks and the formulation of several debatable questions which rise during the reading of this new text.

The first remark concerns the disproportionate difference in space devoted to the treatment of different subjects. In the above-mentioned book by V. S. Pyshnov, the chapters on aerodynamic design, dynamics and stability were almost equal in length (the chapter on stability being somewhat shorter). The same applies approximately to the texts used in the Zhukovskiy VVIA [Air Force Engineering Academy] even now: the length of B. T. Goroshchenko's "Aerodynamic Aircraft Design" and "Dynamics of Aircraft Flight" is about equal. The text by V. S. Pyshnov on "Stability and Controllability of the Aircraft" is somewhat shorter. In the work by Ostoslavskiy the material on stability and controllability occupies more than one and one-half as much space as do aerodynamic design and dynamics combined. The problems of dynamics had, in

general, bad luck. They are excessively condensed and represent a little more than 10% of the book.

Another remark. One might expect the presentation of the special features of supersonic aircraft in a text published in 1957 to be more prominent. Here, however, there are unfortunately no sections devoted to the analysis of such special features. The author can obviously be rebuked for the fact that ten years after the appearance of his book "Aerodynamic Aircraft Design" the materials for the chapters on this topic have hardly been elaborated on in the present text.

The total lack of information on the special features of formation flying and combat maneuvering of aircraft is somewhat surprising. They are treated in textbooks by B. T. Goroshchenko, and the practical aspects of the course gains from this. In the work under review these new and rather vital questions have been ignored. As a result, the work appears drier and more academic.

Finally, our last general remark concerns the fact that the widely accepted principle in aviation — "from simple to complex" — is not followed. The author often begins with complicated equations which are at first difficult to grasp. Simpler and easier-to-grasp alternatives follow as simplification of the more complex. It suffices to mention that the description of steady horizontal flight is not stressed in the text; cases of flying at an angle to the horizon are given right at the beginning. Let us proceed with a more detailed review of the text chapters.

The preface gives a concise historical review of the development of the course, and scientists, both here and abroad, through whose work the course was mainly created, are mentioned. In our opinion, Otto Lilienthal, after whom the polar of an aircraft has been always called, and Tsiolkovskiy, who has far outdistanced other researchers in the treatment of the basic problems of aerodynamic design, have been undeservedly forgotten.

The author points out in the introduction the two main problems arising from the study of aircraft motion:

"What is the connection between the external forces acting on the aircraft and the trajectory of flight, and what is the connection between external forces and the kinematic parameters of motion (velocity and altitude of flight, angular position of the aircraft in space)?

"What is the stability of various kinds of aircraft motion and what is the controllability of the aircraft?"

It seems to us that here begins already the minimizing of dynamics which is clearly manifested later on.

The first part of the text is called "Dynamics of the Aircraft as a Material Point". This title, in our opinion, is not quite appropriate. It is true that it closely conforms to the remark made by V. P. Vechinkin that the aircraft is regarded in dynamics as a material point (center of gravity) on which all the forces are applied. But in this remark the conventional nature of such a point of view is stressed. When this concept, on the other hand, is included in the title of an entire unit — so to speak, is exaggerated — a series of puzzling questions arise. For instance, how can one speak of angular position of a point in space? (While angles of attack, slipping and banking are treated in the first part.) How can longitudinal and lateral motion be differentiated? And, finally, how can the concept of a lifting force be formulated, if the existence of the plane of symmetry of the aircraft is neglected?

In a number of places I. V. Ostoslavskiy formulates the problems of aerodynamic design. But this formulation is not always convincing. Thus it is pointed out at the close of the introduction that aerodynamic design is reduced to the calculation of the motion of the aircraft under the action of external forces, independent of the function of the empennage, when it is not required to take into account the equilibrium of moments. Aerodynamic design will then include cases of unsteady motion, which is already contrary to the terminology of Vechinkin, who included in the aerodynamic design only problems of unaccelerated flight. On page 29 of the text I. V. Ostoslavskiy also makes the remark that "... often in practice only the calculations of steady flight are called the aerodynamic design of the aircraft".

On page 60 the possibility of dividing aerodynamic design into two parts is emphasized again, i. e., into that of steady and unsteady motion. Here we already have a sharp deviation from Vechinkin's terminology, who regarded aerodynamic design a part of dynamics, but not vice versa.

This is not simply a discussion of terminology. The fact is that the cases of unaccelerated flight progressively lose their importance for modern aircraft. Therefore even the familiar concept of maximum velocity becomes sometimes vague. At the same time the treatment of simple cases of rectilinear flight with constant velocity is the foundation on which more complex formulations are based. It seems to us that it is necessary to abandon the title "Aerodynamic Design" since the contents are not determined by the title. It is better to use the title "Design of Flight Regimes" to be followed by "Dynamics of Flight". In passing, let us note that the term "steady regime" is sheer tautology, since a "regime" is something definite, something established. It is furthermore clear that the expression "unsteady regime" should not be used at all, since it combines two contradictory concepts.

The surprising figure of 5 m/sec. for vertical speed for service ceiling meets the eye on page 66. The increase of this figure as compared to the previously recommended figure of 0.5 m/sec. is correct. Some time ago we came to the same conclusion from the analogy between the flight of a single aircraft near the ceiling and of a wingman in formation. But it is more correct to speak, not of the absolute figure of vertical speed for the service ceiling, but of the value of the angle of climb.

The interesting rule of controlling speed with the elevator and the trajectory angle of inclination by the use of the throttle is stated on p. 75 (and supra). It is correctly emphasized that this holds only for steady motions. But the trouble is that the intervention of the pilot in the control will itself cause a disruption of the steady regime. In this, dynamics is always manifested. Therefore the correct statement that the control of the trajectory angle is accomplished with the aid of the throttle, and not with the aid of the stick, appears incorrect.

In the presentation of the rpm method for an aircraft with a turbojet engine we read on p. 94: "Very recently Prof. V. S. Vedrov and M. A. Tayts have employed the rpm method in the analysis of test flights of aircraft with turbojet engines..." Justice demands that we mention that these ideas were developed in a thesis by S. Sh. Fradkov, topnotch engineer of HQ, Air Force Scientific Research Institute. This thesis also indicated a direct connection between these concepts and the rpm method developed by V. S. Pyshnov and S. G. Kozlov for aircraft with a fixed-pitch propeller.

The treatment of the power method in a separate chapter was not really necessary in our opinion.

Surprising also is the assertion (p. 100) that, with increased altitude, the thrust of a turbojet engine drops in a 0.87 proportion to the relative air density. It is true that this is quoted for constant Mach numbers, not speeds. Nevertheless, the drop appears to be too sharp.

The treatment of flight range is presented mainly in analytical terms without illustrative examples and reference figures. The emphasis on the advantage of jettisoning the load at the terminal point of flight before returning is unnecessary, it seems to us. This may lead to the erroneous conclusion that large bomb loads are desirable.

Unfortunately absolutely nothing is said about the flight range of supersonic aircraft and about the estimate of fuel consumption for acceleration.

A short analysis of the increase of range achieved by in-air refueling gives a good impression. However, the dynamics of such refueling are not mentioned.

At the beginning of the chapter six it is mentioned that, previously, cases of flight were examined for which the force of inertia could be neglected. It should be stated that at present the treatment of the basic aspects of dynamics (in particular those of turning) without taking into account the inertial forces, proposed by V. S. Pyshnov as early as 1938, is gaining wider acceptance. Anticipating ourselves somewhat, let us say that the statement (p. 166) on the need in the turn "of a centripetal force, directed towards the center of the trajectory curve and balancing the centrifugal force" can cause confusion. The centripetal force is always equal to the centrifugal force, since the former is the reaction to the latter. Experience in teaching shows that it is more convenient to use the term "the curving force" and to regard it as unbalanced, leaving the problem strictly in the realm of dynamics.

On p. 158 an example is given of an aircraft's "settling" when coming out of a dive. The combination of a speed of 404 m/sec. with an angle of attack of 10° in this example is somewhat frightening; it is done to obtain a considerable speed of descent (70 m/sec.) at the beginning of "settling".

A strange impression is made by the remark on p. 162: "The loop was executed for the first time by the Russian military pilot P. N. Nesterov in 1913 over an airfield near Kiev. From that time the maneuver has been called the Nesterov loop". Readers know well that this term stems not at all "from that time", because the tsarist military clique could not fully appreciate the innovational work of Nesterov. The term "Nesterov loop" was introduced comparatively recently at the request of public opinion in Soviet aviation.

We have already pointed out that the problems of dynamics are less extensively developed in the book as compared to other topics. In particular the timely question of the possibility of raising the aircraft above the service ceiling by the use of high velocities — characteristic of modern aircraft — is completely neglected. The problems of combat maneuvering — a practical application of dynamics — have not been discussed. Turns are treated only insofar as they apply to a single aircraft.

The treatment of stability and controllability, as we have already mentioned, is too unwieldy: out of 556 pages in the book, 350 are devoted to these topics.

Let us not discuss these chapters in as much detail as the previous chapters. We would just like to make one remark. The arrangement of material is more successful, in our opinion, in the book "Longitudinal Stability and the Controllability of the Aircraft", where the problems of dynamic stability are discussed somewhat further on.

We have enumerated the basic questions that come up when reading the new text.

On the positive side can be mentioned the high overall scientific level of the text, the good arrangement and clear presentation, the inclusion of practical problems illustrating the main sections.

Undoubtedly the new text will be of great use to students of aviation schools of higher learning, as well as to students of engineering academies and schools.

Professor, Doctor of Technical Sciences,
Engineer Col. V. F. Bolotnikov

I MUST MAKE IT...

Military Pilot of the Chinese Peoples Republic Cheng Yu-kwi

The 30th anniversary of the Chinese Peoples Liberation Army falls on 1 August. Founded and led by the Chinese Communist Party, it has had a great and glorious past. The Peoples Liberation Army secured an historic victory of the Chinese People over the combined forces of imperialism and internal reactionary forces. The Chinese Air Force also added a glorious page to its history. The pilots of the Peoples Liberation Army bravely fought the Japanese, the American and Chiang Kai-shek's air pirates who were raiding peaceful cities and towns. Chinese volunteer pilots set an example of courage and bravery in combats with the American interventionists in Korea.

The soldiers of the Peoples Liberation Army faithfully guard the sacred boundaries of their country. "We do not intimidate anyone nor do we threaten anyone," editorialized the newspaper Tsefangtsunpao recently, "but we will not allow anyone to claim our territory, to violate our peaceful border!"

We are giving below a story told by the pilot Cheng Yu-kwi which is a testimonial to the courage and skill of the men of the Peoples Liberation Army.

On 17 December 1952 we took off to intercept hostile F-86 aircraft. Having spotted them, our element swung to the left and started the attack. I was the commander's wingman. At the moment when my lead plane headed towards the enemy, one F-86, after a maneuver, began to close in on him in an attempt to break up the attack. The commander, in the heat of combat, made a turn to the right and thereby placed himself in a disadvantageous position. The enemy plane kept closing in on him unhindered. I warned the commander by radio and immediately made a turn myself, ready to strike first at the enemy. When the American pilot saw me he declined the attack, made a roll, and tried to get away by dropping. But here I caught him in my sight: one or two seconds later a burst of gunfire would riddle the enemy aircraft. A thought flashed through my mind: "You have just one idea right now — to escape, but I won't let you do it!" I didn't want to let the enemy slip away and, having dived sharply, I started after him. The enemy plane began to pull out of the dive. The distance diminished quickly. I could see the cockpit distinctly and the man who was sitting there. One burst of fire, then another.

But as a consequence of too tight a maneuver, the sight reticle image "washed out". I had to cease firing while the enemy kept going. Whenever he zoomed I followed him. Whenever he darted to the left I turned after him, pressing him from the rear.

All of a sudden several enemy planes jumped me, trying to help out their pilot. Like a pack of ravenous wolves they kept pressing me from all sides — from above, from the rear, from the right and from the left. I was very close to the enemy plane, and since the others apparently were afraid to hit it, they didn't dare open fire, and only kept pursuing me stubbornly. I fired a long burst at the enemy and, with a right turn, tried to shake the pursuers.

But my plane was "clamped in a vise"; the enemy took advantage of his position and opened fire.

Several holes appeared on the wing of my plane. I mustn't wait any longer. I jerked the stick energetically and zoomed. At this moment the bullets pierced the fuselage of my aircraft, the plane shook and suddenly pulled up ; because of the increased G-force, I blacked out momentarily. After some time I came to and became aware of an icy wind whistling by: the glass of the cockpit canopy was shattered.

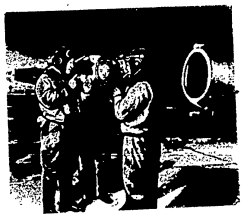
I looked around; there was no trace of the enemy. The plane kept climbing steeply and the speed kept decreasing. I tried to recover from pitching, but the control stick didn't move. The plane didn't obey the controls and kept climbing. Another second and it would loose speed and go into a spin. "Then I won't have any chance to right the aircraft at all" — this was the thought that crossed my mind. The control stick didn't move forward beyond neutral. The only thing left was to bail out. "Bail out! That means losing my favorite partner in battle which belongs, not only to me, but to my country and to the people! The people built it with their blood and sweat, and then entrusted us, the soldiers, with it. I mustn't give up, mustn't lose the aircraft under any circumstances. It's absolutely necessary to find a way out and to get back," — I thought and at once I had a plan: how about making a half-roll?

Without any further deliberations I kick the rudder, pull the stick to the left, and pull up into a turn. The plane rolled over, slowly dropped its nose, and started to descend, gaining speed all the time.

This success inspired me, strengthened my faith in the possibility of setting my plane down on my home field. I'll bring it in without fail, this was my firm decision.

After gathering speed in inverted flight I brought the plane into the normal position again. A prolonged inverted flight is not particularly pleasant. Cold wind was blasting into the shattered cockpit, stinging my face, and I could hardly keep my eyes open. I leaned forward in order to hide from the stinging wind.

I kept on going, now in a normal, now in an inverted position, and was slowly nearing the airfield. It was located in the midst of extremely hilly terrain. I had already descended to 3000 meters, and couldn't roll over any more or I would crash into



Pilots of the Chinese Peoples Republic are constantly improving their combat readiness and flying skill. They learn to fly and to carry out complicated missions under various weather conditions and at night. In this picture pilots are exchanging information concerning night flights on instruments.

one of the high hills. But I had to go down. So I banked the plane about 45°, and spiraled down to 1000 m. It was dangerous to go any lower; I had to maintain this altitude. I kept banking the plane 60-70° to the right and then to the left, and snaked my way to the field.

A new difficulty loomed: How to make the landing approach and how to land the aircraft? My mind was trying to find a solution, and here it was! I would approach for landing with a side slip, and before touchdown I would eliminate the bank.

But I had to carry this out with great precision, since if I were to touch down even with slight drift I could smash the landing gear or even the entire plane. This was very risky, but I had no choice. I pull down the landing gear extension lever, but without any result. There was no pressure in the hydraulic system. I pulled the emergency landing gear handle, and after a short jerk forward the landing gear was extended.

I had a feeling of a tremendous relief. Now everything was going to depend on my skill in eliminating the drift. I banked the plane to the left and descended with a slip. The aircraft obeys my will and holds steadily on the landing course. A few tormenting moments go by, and my aircraft with its perforated wing, its riddled fuselage and cockpit, touches down at its home airfield.

AVIATION ABROAD

AIRCRAFT MONOPOLIES IN THE USA — THE ENEMIES OF PEACE AND DISARMAMENT

Capt. S.M. Yermakov

The 20th Congress of the CPSU presented an exhaustive analysis of the international situation and took a stand on crucial questions in the present international situation. Having reiterated that the Leninist principle of the peaceful coexistence of states of different social regime was and still remains the general line in the foreign policy of the Soviet Union, the Congress pointed out realistic possibilities in the present international situation for preventing the aggressive forces of imperialism from involving nations in a new war.

On the other hand, the resolutions of the Congress emphasize the stand that "since imperialism is in existence, there exists an economic basis for the occurrence of war. That is the reason why we must maintain utmost vigilance. As long as capitalism remains in existence the reactionary forces which represent the interests of capitalistic monopolies will strive toward military adventures and aggressions in the future as well, and may try to provoke a war."

Experience clearly corroborates the truth of the Marxist prognosis of the Communist party.

In striving to prevent lessening of international tension, the imperialists of the USA, England, France, and other capitalistic nations, try to cast aspersions on the peace-loving policy of the USSR, they deceive public opinion by all possible means; foster war hysteria in their attempts to justify their policy of further armament races and of preparation for a new war.

Reactionary circles of the USA are headed by the aggressive forces of imperialism. With their approval, the governments of England, France, and Israel, have precipitated a war against Egypt, making an attempt to subject the freedom-loving Egyptian nation once again to colonial slavery. With direct moral and material support of the imperialists, uprisings were started by the counter-revolutionary underground in Hungary in order to overthrow the lawful people's government and to create in the center of Europe a nest of fascism and aggression.

The sorties of the enemies of peace collapsed ignominiously. The international reactionaries were forced to withdraw. But they have not laid down their arms and are persistently seeking new ways of fostering the cold war and of increasing tension.

On 5 January 1957 President Eisenhower, in his message to Congress, formulated the basis of the imperialistic policy of the USA towards the countries of the Near and Middle East. This so-called "Eisenhower Doctrine" is designed to effect far-reaching economic expansion and direct military aggression. The US imperialists, by using the

old methods of colonialism, want to seize important strategic areas, rich in oil, thereby displacing their "partners", England and France.

The government of the USA has already begun to carry out a series of military measures which, in the opinion of their reactionary politicians, will make sure that the "Eisenhower Doctrine" is carried out successfully. The USA is concentrating Air Force units in the vicinity of the Mediterranean and at a number of points in the Near and Middle East. From the news in the American press, the 6th US Mediterranean Fleet has already been issued atomic armament; in January battalions of Marines landed in the Gulf of Persia and on the shores of Africa. Again, in April a task force of the US 6th Fleet left Italian and French ports and entered the waters of the Eastern Mediterranean. This action was directed against the independent Arab country of Jordan. The United Press agency cynically calls the American 6th Fleet the "prime weapon of the Eisenhower Doctrine".

The events in Jordan and the serious worsening of the situation in the Near and Middle East caused by the USA illustrate the widely publicized "Eisenhower Doctrine" rather well. Its imperialistic content has been proved to a sufficient extent.

The US Air Force organized a non-stop flight in January 1957 of three B-52 bombers over a distance of 24,325 miles (39,147 km). The route ran over the countries of the Near and Middle East, which represented a "military demonstration", by admission of Maj. Gen. Old, commander of the flight.

Refueling of the B-52 aircraft took place from one of the US military air bases located in the Middle East. This, in the opinion of observers in Washington, was an attempt on the part of the "US government to convince those Congressmen, who take a skeptical view of the American policy in the Middle East, of the necessity of maintaining a net of bases in that region".

Former US Air Force Secretary Quarles stated in his speech to the reserve officers of the Air Force in February 1957 that it is necessary to "banish every thought that the USA will not use atomic and thermonuclear weapons in the war against the USSR! He added further that in the event the USA entered any "little war", they will also employ atomic weapons. Quarles has not deemed it necessary to dissemble before the reserve officers the imperialistic policy of the USA directed towards provoking a war against the Soviet Union, the countries of people's democracy, and also against former colonies, now on the road towards independent development.

This policy was reflected in the US budget for 1957/58. In his message to Congress, President Eisenhower considers the main function of the budget to be that of supplying the atomic air forces of the USA with all the necessary materials to demolish the enemy before the commencement of his attack. The message contains unconcealed threats towards the Soviet Union and the countries of people's democracies. The proposed US budget earmarks 45.3 billion dollars for preparation for the new war; this amounts to 63% of the total budget and is almost 3 billion dollars more than last year.

The course of action of the imperialistic circles in the USA towards the preparation and provocation of a new world war is a direct consequence of the politics of monopolies which are vitally interested in the armament race. It is these selfish interests, the desire to receive maximum profits, which completely shape the policies of a capitalistic country.

Recently the position of aircraft monopolies in the USA engaged in manufacturing of aircraft, power plants, and equipment, has become especially strong. Military aircraft monopolies have been bitterly attacking for several years the principle of "balanced development of armed forces" formulated by the military circles of the USA. They achieved a victory by moving ahead of other military and technical monopolies. This is how the results of this "victory" are manifested in competitive struggle.

In the US budget for 1957/58 the appropriations for the Department of the Air Force increased almost five-fold as compared to the year 1949/50, and amounts to 17,472 million dollars, which represents 46% of the total military appropriations. In the last six years a huge sum of almost 100 billion dollars was appropriated for the Department of the Air Force, and this without taking into account multibillion spendings on the air forces of the Navy and the Army.

Particular attention is given in the 1957/58 budget to strategic aviation: of all funds appropriated for aircraft construction a good half is intended for construction of strategic bombers. By the end of the year it is planned to have only B-52 jet bombers in all of the 45 wings of the Strategic Air Command. The Air Defense Command of the USA is to have 32 wings, tactical aviation 51 wings, a total of 128 combat wings (without naval and army aviation).

No less attention is paid to guided and ballistic missiles. The appropriations for their construction amount to 2039 million dollars, which is twice the sum in the budget for the last fiscal year.

The main emphasis on the Air Force is also seen now in the formulation of the military doctrine of the USA. The "Military Review" pointed out in April 1956 that the statement of President Eisenhower on the "shift in the direction of full utilization of air power" has become the "philosophy of national security". After the President, Secretary of State Dulles and Secretary of Defense Wilson made statements on the necessity of directing the main efforts towards the development of the Air Force, guided and ballistic missiles, and other destructive weapons of warfare.

This change has drawn sharp protests from the military leaders of the Navy and the Army. Nevertheless one thing is certain: the USA exhibits now a transition from the principles of balanced development of the armed forces towards the building of superpowerful means of destruction for long-range aggression: the Air Force, guided and ballistic missiles, atomic and hydrogen weapons as the first order of priority.

The increased influence of military aircraft monopolies is also manifested in the fact that their henchmen are appointed to key military positions. Thus, Air Force General Norstad has been appointed military commander of the aggressive North-Atlantic Alliance. Twining, former US Air Force Chief of Staff, became Chairman of the Joint Chiefs of Staff. The appointment of Twining is the first instance of an Air Force General's being appointed head of all military services. The American press reports that the most probable successor to retiring Secretary of Defense Wilson is former Air Force Secretary Quarles.

In developing reactionary policies of provoking a new war, the Wall Street magnates cooperate closely with the military leaders of the USA. They are united by extreme aggressiveness and mutual interests in speeding up the armament race and increasing military spending. Their interests are tightly knit. Let us look at the facts. Former Air Force Secretary Talbot is one of the biggest capitalists of the USA. He had close ties with the "North American Aviation" aircraft company, with "Chrysler" company, was director and co-owner of a number of financial and industrial corporations. His successor, Quarles, is vice-president of "Western Electric" and president of a large

atomic firm, the "Sandia Corporation". Murphy, the newly appointed Special Assistant to the US Secretary of Defense on the problems of guided and ballistic missiles, is president of "Esso Research and Engineering".

For services rendered the aircraft monopolies in awarding military contracts, many generals and officers of the US Air Force, upon leaving the service, occupy high positions in the administration of aircraft firms, with huge salaries, bonuses and pensions. Generals and officers in retirement are the link between the monopolies and the top of the military echelon.

According to "Economic Notes" (Sept. 1956) the "Boeing Airplane" aircraft company and its subsidiary "Convair" have each on their staff 67 generals and officers, whose status is not clearly defined, but who are kept in highly paid positions because of extensive connections in the Defense Department. Retired Lt. Gen. McNarney became president of the "Consolidated Vultee" aircraft firm (a subsidiary of the "General Dynamics Corporation"); General Eckert became vice-president of the "Hughes Aircraft" company; General Devers became technical consultant for "Fairchild Engine and Airplane"; General Quesada became vice-president and manager of "Lockheed Aircraft".

Even the American press feels forced to point out the fact that often "a general of the Supreme Headquarters of the Air Force openly advises purchasing the product of a particular aircraft firm, even though the quality of their aircraft gives rise to a multitude of objections from the experts. Then, some time later, you will meet the same general in retirement; he has become a highly paid president of a corporation which manufactures aircraft".

Over one hundred aircraft companies in the USA (aircraft construction, engine and power plants, helicopters, guided missiles, etc.) are combined into an Association of Aircraft Industries. This powerful monopolistic combine plays a rather important role in the economic and political life of the country. This is the organization which determines the policy in regard to the Air Force and the preparation of a war of aggression by the United States in general.

The first place among the aircraft suppliers belongs to "Boeing Airplane" whose share of the military contracts was almost one billion dollars last year. Because of strengthening of ties with the top echelon of the Department of the Air Force, the company has displaced from first place, as far as military contracts are concerned, even such a company as "General Motors". According to the press, in 1957 "Boeing Airplane" will produce monthly 20 B-52 bombers, 20 KC-135 air tankers and will manufacture the "Bomarc" guided missiles.

The second place in the size of military contracts is taken by the "North American Aviation" company which produced the F-86 ("Saber") fighters in 1955, and in 1957, the F-100 fighters. In addition, it has under development a twin-engine aircraft for the Navy, as well as the "Navaho" guided missile.

Next comes the "General Dynamics Corporation" which, in the opinion of the American press, has a great future. This is a powerful military-industrial concern which produces aircraft, power plants, and equipment; they own atomic energy and industrial electronics plants; their subsidiaries are scattered throughout the USA, Canada, and Europe. The "General Dynamics Corporation" concern is building fighter-interceptors, bombers; is readying for production a sea based fighter-interceptor; is working on secret guided missiles. The concern puts especially high hopes on their B-58 ("Hustler") bomber which will replace the B-52 bomber.

Among the largest military suppliers are the following companies: "United Aircraft" (jet and turbojet engines), "General Electric" (atomic turbines for aviation, electronic equipment and communication), "Lockheed Aircraft" (fighters and military transports), "Douglas Aircraft" (military transports), "Curtiss-Wright", "Glenn-Martin", and others.

All of these companies receive huge excess profits from Air Force contracts. This is the reason why they are vitally interested in the armaments race and especially in the increase in spending for aircraft and guided missiles. Thus, the profits of "Cessna Aircraft" have increased in only one year (September 1955 to September 1956) by 148%. The "General Dynamics Corporation" concern has made almost twice as much clear profit in the third quarter of 1956 as in the same period for 1955. Other aircraft companies have also substantially increased their profits. And yet the year 1955 was regarded in the USA as a boom year for the military industry.

On the basis of the profit analysis of various companies, some American periodicals came to the conclusion that profits made by aircraft firms on military contracts were three times as great as those made on commercial non-military orders ("Economic Notes", September 1956).

The US government, which represents the interests of the capitalist tycoons, in turn extends firm support to the military aircraft companies in the form of accelerated amortization of equipment (in 5 years instead of the usual 25). The government finances the scientific research work of the aircraft companies, supplies them with specialized equipment and trained manpower, extends guaranteed loans, gives them all kinds of advantages, protects them in every way. With the present situation in military procurement, practically all equipment for the Air Force, spare parts, aircraft and airfield equipment are obtained only by direct negotiations between the central procurement departments of the US Air Force and a selected circle of suppliers. Monopolies prefer to work secretly; they do not like it when the facts about their huge profits on military contracts made at the expense of the taxpayers, i.e. the working masses, are made public. It was on their demands that the Defense Department established these closed negotiations. By obviously minimized official reports alone, 94% of all contracts placed by the Defense Department in the past two and one half years were awarded through direct negotiations.

The prices of military aircraft in particular, are rapidly rising as a result of machinations by the aviation monopolies, which can "get away with anything". The cost of the B-29 bomber was 629 thousand dollars at the end of W. W. II, whereas a B-36 cost 3.5 million dollars in 1951; and now a B-52 already costs about 9 million dollars. Out of these huge sums the lion's share settles in the safes of the largest manipulators of the monopolistic business whose profits increase very rapidly. Thus 100 shares of "Douglas Aircraft" cost 1150 dollars in 1950 and now are valued at 49 thousand dollars (43 times as much!).

Sometimes the politicians in the USA are not averse to "making noise" about military profits, especially in the year of a presidential election or an election to Congress. But this noise and commotion are used to lull public opinion and to cheat the people. In 1956 a special committee of Congress was studying the question of the excess profits of aircraft companies. After many months of work, the committee reported that the profits of aircraft companies on military orders were on the same level as those of other branches of industry and did not give cause for undue concern..

Even the American press could not stand such falsification and has exposed the findings of this committee. The journal "Economic Notes" wrote that the committee (of course not accidentally) has not taken into account in the analysis of profits the fact that equipment and complete plants belonging to the government and worth a huge sum of money are used gratis by aviation monopolies without any payment of rent. Military aviation monopolies have capital investments of 200 million dollars, but they are using government shops and equipment to the amount of 900 million dollars.

Thus huge profits, created by the working masses in the government factories which are built with their money, go to military aircraft monopolies. Is this not an example of "national capitalism" which is so assiduously praised by the reactionary ideologists of the USA?

Military aviation monopolies in the USA are trying to increase production and obtain additional profits by filling orders of other countries, members of aggressive military blocks headed by the USA. This is the reason why the policy of increased consignment of weapons to the allies of the USA, the policy of further armament racing was so diligently formulated at the last NATO session by US Secretary of State Dulles and Secretary of Defense Wilson. Immediately after the NATO session, the voice of the business circles of the USA, the newspaper "Wall Street Journal" (21 Dec. 1956) noted with satisfaction that the meeting would be followed by rush orders to the American industrialists for guided missiles, rockets, jet aircraft, the most modern radar installations.

The paper further stated that in conjunction with the production of guided missiles of the "Matador" and "Honest John" type there is talk in certain technical circles of production of "more modern, ultrasecret weapons".

The events in international life again and again bear witness to the fact that the reactionary clique of militant US politicians in carrying out the will of their bosses, the powerful monopolies, is violently attacking the simple and clear proposals of the Soviet government on armament reduction.

The frenzied armament race and the policy of provoking aerial-atomic war by US imperialists are the links in one and the same chain. It is quite clear that in these conditions our armed forces and, above all, the Air Force must be constantly prepared to frustrate every machination on the part of the enemy. Constant vigilance by the Soviet Armed Forces, high technical preparedness and military skill of all military personnel is a safe assurance of peace, a guarantee of the fact that the endeavors of capitalistic monopolies to provoke a new world war will be a complete failure.

Officer A. I. Kabanov, one of the leading military navigators first class, who has mastered to perfection precision navigation at various altitudes and in adverse weather. He has been awarded by the government the Order of the Red Star for his skill and superior performance in combat training.

Photo: Yu. N. Skuratov

CONCERNING THE READERS' QUESTIONNAIRE

In the December 1956 issue of the journal "Herald of the Air Fleet" there appeared a "Readers Questionnaire". During the first months of this year the editors received a great number of replies to these questionnaires in which readers pointed out positive qualities of the journal and expressed their observations and suggestions.

The majority of articles published under "Tactics" have been favorably evaluated. Reader I. S. Syrovetnik has singled out the article by I. G. Ponomarev. "Concerning the AA Evasion Maneuver by a Single Bomber" as the most useful, while officer L. P. Nechayev has singled out the articles by L. I. Savichev "Interception of a Maneuverable Target" and by D. F. Goldyrev on "Simultaneous Attack of a Single Bomber by a Pair of Fighters" and a number of other articles on the tactics of fighters and bombers at low and high altitudes.

Many readers (V. M. Pugachev, P. A. Davydov, R. A. Zazolin, and others) express the same view that the series of articles appearing in the journal under the title "From the Experience in Pedagogical Work of Squadron Commanding Officers" has proved to be quite useful to Air Force commanders. At the same time, reader M. M. Fenin, for example, thinks that the journal gives insufficient coverage to the experience of top-notch Air Force officers in insuring accident-free flying.

A number of readers consider it imperative that the treatment of the problems of night and high altitude training of pilots be extended, as well as that of flights under adverse weather conditions and of the physical training of crews. "In the articles on flight training under adverse weather conditions," Com. V. V. Popovich writes on his questionnaire, "few examples are discussed of competent action by pilots faced with the failure of air navigational instruments in a given weather minimum."

Judging by the questionnaires, articles by V. S. Pyshnov and A. P. Melnikov on various problems of aerodynamics at supersonic speeds proved to be quite useful for most readers. This opinion in particular is expressed by A. M. Baranov, V. N. Shilo, A. G. Tarasov, E. L. Gol'dberg, N. A. Royenko, and others. In the opinion of these readers, articles on similar topics must be published more frequently by the journal because of the lack of popular books and texts on supersonic flight speeds.

Critical remarks and suggestions are contained in the questionnaires returned by readers V. G. Vorob'yev, S. K. Rapoport, V. I. Lyamets, I. I. Shul'gin, V. A. Shtal', N. S. Kartavenko, and others.

Remarks and suggestions by readers were analyzed and discussed at the meeting of the editorial staff. A number of proposals made by the readers have already been implemented; other proposals have been incorporated in the plans of the journal for the second half of 1957.