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MILITARY AFFAIRS

AVIATION AND COSMONAUTICS

No 11, NOVEMBER 1986

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Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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PLEA TO FOLLOW THROUGH WITH "RESTRUCTURING" REFORMS IN AIR FORCES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 1-3

[Editorial, published under the heading "Implementing the Decisions of the 27th CPSU Congress": "Implementing the Energy of Concepts Into Concrete Deeds"]

[Text] The Soviet people and all progressive mankind are celebrating an important date -- the 69th anniversary of the Great October Socialist Revolution. The worker class and Russia's toiling masses, under the guidance of the Leninist Party, toppling the bourgeois-landowner system, ignited over the world the dawn of a new day. "The Great October Socialist Revolution," streses the new revised Party Program adopted by the 27th CPSU Congress, "became a turning-point event in world history, defined the general direction and fundamental trends of world development, and marked the beginning of an irreversible process -- the replacement of capitalism by a new, communist socioeconomic system."

The USSR is the trailblazer into a communist tomorrow. Its happy destiny is to put the plow to the virgin soil of history. It is a fortunate and at the same time difficult destiny, for practical realities are constantly advancing new and complex tasks in the economic, political, social, military, and other domains of societal activity. At the present, turning-point stage in history, the party sees success in the cause of socialism and communism in a substantial acceleration of this country's socioeconomic development on the basis of achievements of the scientific and technological revolution, bringing the forms and methods of socialist economic management into conformity with today's conditions and needs.

The Soviet Union is displaying an example of new political thinking and action. Soviet peace initiatives, the Soviet Government's decision to extend its unilateral moratorium on nuclear testing to 1 January 1987, the ideas and points set forth by Comrade M. S. Gorbachev, General Secretary of the CPSU Central Committee, in his replies to questions submitted by the newspaper RUDE PRAVO evoked profound gratitude and support on the part of our people and the entire world progressive community. This was another vivid confirmation of the firmness of our party's strategic course of policy and noble aims.

Today we are witnesses to and participants in restructuring of the economy and the spiritual-ideological domain, the work style and methods of the party and all our cadres, including military and military aviation cadres. Comrade M. S. Gorbachev noted at a conference of activists of the Khabarovsk Kray party organization that the goal is to achieve no less large-scale transformations than during the years of the first five-year plans, the postwar rebuilding and development of our nation's economy. "I would place an equal sign between the words restructuring and revolution," he stated in his address. "Our transformations and reforms outlined in the decisions of the April Plenum of the party Central Committee and the 27th CPSU Congress constitute a genuine revolution throughout the system of relationships in society, in people's minds and hearts, in the psychology and understanding of the present period and, particularly, the tasks engendered by rapid scientific and technological advance."

The process of renewal, which has embraced all domains of Soviet society and the Armed Forces, is also taking place in military aviation. Engendered by the Great October Revolution and created under the guidance of V. I. Lenin and the party, the Soviet Air Forces are presently going through a qualitatively new stage in their development. It is a component part of a nationwide and partywide restructuring and involves technological improvement of the Army and Navy and an increase in their historical responsiblity for reliable defense of peace and socialism in an environment of a militarist psychosis being whipped up by imperialism. Restructuring of the consciousness and methods of aviation cadres takes on a leading role in these conditions. And the stringency of demands on commanders, political agencies, Air Forces party and Komsomol organizations for its implementation is the very highest, for any delay means delay in accomplishing the main task -- maintaining Air Forces strategic parity.

Nor can one ignore those problems with which the Air Forces began the restructuring process, as well as those which arise in the process of restructuring. What is being sought is conformity between the organizational forms of combat training, party-political work, and the level of development of technology, further increase in competence of cadres, broadening of the capabilities of the domain of combat support, plus other items which brook no delay. There has been sufficient time to obtain a clear understanding of the tasks at hand, and now one must prove one's desire and ability to restructure through concrete deeds and by improving results in combat and political training.

The June (1986) CPSU Plenum armed us with methodology, while practical experience, know-how, and fundamental indices in combat and political training as well as socialist competition achieved to date have provided us with certain factual material for analysis and objective appraisal of accomplished work. What can be noted in this connection?

The strategy of acceleration is exerting increasing influence on development of the Air Forces. On the whole the political guidelines and program tasks proceeding from the decisions of the 27th CPSU Congress, party Central Committee plenums, and the instructions of Comrade M. S. Gorbachev, General Secretary of the CPSU Central Committee, on defense matters for the Armed

Forces and Air Forces are being carried out. The necessary moral-psychological potential is being created for solving urgent problems. A certain mood for change is sensed in the majority of aviation units and subunits. The plans and decisions of commanders, political agencies and headquarters staffs, staffs of scientific research establishments and educational institutions are finding concrete embodiment in certain increases in combat readiness, intensification of combat training, and broadening of utilization-ready combat capabilities. The results of the training year attest clearly to this.

Truthfulness in evaluations and the ability to develop active innovation on the part of military aviation personnel, a sense of the new, as well as organizational stick-to-itiveness have enabled the leader-Communists and party organizations of the vanguard units and subunits in which officers A. Bezrukikh, P. Kolesnikov, G. Shcherbinin, V. Kozlov, N. Tankushin, and M. Pinchuk serve implement in concrete deeds better than others the spirit of restructuring. These units have increased by an average of 7-10 percent the effectiveness of total flight hours logged, a steady trend toward increase in achievement of combat capabilities has been noted, and the search for and practical verification of more effective forms and methods of combat and political training are successfully being accomplished.

Here is a graphic example of skilled development of aggressive innovativeness by military aviation personnel as a foundation for acceleration. The pilots of the regiment in which party member Lt Col A. Gunko serves as air, weapons and tactical training chief have developed at their own initiative more than 20 fundamentally new tactical variations of organization for and conduct of air-to-air combat. They have computer-checked all calculations and have backed up their conceptual theses at tactical air conferences and tactical drills. With the permission of command authorities, tactical innovations have been tested in the air, utilizing a mock adversary. Subsequently regimental personnel successfully accomplished all assigned tasks, with the most rigorous verification. A valuable element in the experience of this unit is the fact that it is precisely the combat pilots themselves who, by their enthusiasm and innovativeness, are creating and perfecting an arsenal of combat tactics for the new-generation fighters. An innovative, practical approach to problems of restructuring is also characteristic of the commanders, political workers, and party organizations of the military units in which officers V. Longinenko, A. Vozov, V. Strelnikov, V. Yudin, D. Tenditnikov, and V. Shatalov serve. By improving organization of the training and indoctrination process, preparation of personnel and equipment, direction and support of flight operations, they have attained tangible results in increasing combat readiness. Leader-Communists G. Obidin, G. Nazarikov, A. Rubtsov, M. Khristoforov, and others are aggressively implementing an important party demand pertaining to all-out strengthening of military discipline, organization, and order.

The commanders, pilots and navigators, and ground crews carrying out their internationalist duty as members of the limited Soviet forces in the Democratic Republic of Afghanistan, as well as those who took part in and are continuing to assist in neutralizing the consequences of the accident at the Chernobyl Nuclear Power Plant are displaying in full measure excellent warrior and professional qualities. Worthy inheritors of the fame and traditions of the fighting men of the revolution and military aviators of the wartime generation, they are not afraid of difficulties and serve honorably and conscientiously. Such persons are capable of accomplishing any and all tasks.

Conscientious military labor, innovative search, discipline and organization have always been and continue to be determining conditions for successful performance of duty by military airmen pertaining to reliable defense of the homeland. The willingness of personnel to give maximum effort in the campaign to achieve further increase in combat readiness and flight operations safety is making it possible to mobilize to the fullest extent people's volition, experience and knowledge in the interests of speeding up restructuring and transforming the energy of conceptual planning into the energy of practical actions. Success in this important endeavor depends in large measure on the style and methods of organizational and indoctrinational activity on the part of political agencies and party organizations as well as an aggressive experiential posture on the part of Communists and Komsomol members, all military airmen, and their ability to think and work in a new manner.

Concern with improving organizational, party work style is first and foremost a need to compare one's plans and deeds with the goals and tasks of restructuring. A study of progress in restructuring efforts in several military transport aviation units and subunits, in the air forces of the Transbaikal, Leningrad, and Odessa military districts has shown that, alongside positive experience, there are also substantial deficiencies. Certain party members, including leader personnel, do not yet fully perceive the specific features of the present period in the development of the Air Forces, are not ready to take decisive actions and are attempting to improve things without changing their work style. Not everybody has a clear-cut program of action to implement the tasks proceeding from the decisions of the party congress. There are those who conceal with an abundance of words tactics of waiting and total dependence on others, who forget that man and his assigned task should be at the center of restructuring. A measure of responsibility for these shortcomings unquestionably lies with political agencies and party organizations which, as is apparent, do not always possess a skilled mastery of political methods of influence on the combat training and indoctrination of military aviation personnel.

One cannot accept this approach to restructuring. Political agencies and party organizations have always actively influenced growth in Air Forces combat potential. We must continue to prize this fine tradition, and we must continue it and further build upon it.

The 27th CPSU Congress and the June (1986) Plenum of our party's Central Committee demanded that Communists eliminate shortcomings not only which lie at the surface, so to speak, but also define the goals and tactics of restructuring, looking to the long-term future, making use of deep-lying reserve potential for acceleration. In order to consolidate and further develop positive changes in the Air Forces, it is extremely important right today to attach national significance to problems pertaining to improving the quality of combat training and mastering new equipment.

This demands of military aviation personnel a qualitatively new level of knowledge and skills and further development of tactics, improvement in the organizational forms of flight activities, moral-psychological training, and dissemination of military technical knowledge. Much is already being done in these areas. A habit has taken firm root, however, in the consciousness of some commanders and their subordinates: a habit of considering to be the main thing not qualitative incremental growth in the combat capability of a unit or subunit but rather quantitative indices of total hours logged, fuel consumed, etc. Political agencies and party organizations are called upon to help people understand that in today's combat success will be determined not only by number of aircraft and quantity of munitions but also by the ability to use them, accuracy of weapons delivery, effectiveness of tactics, proper adjustment of automatic systems, as well as other factors characterizing quality of combat employment of air forces. There is a rule: tactics, from takeoff to landing, should become determining in training combat airmen. It is necessary to wage a resolute campaign against logging "empty" flying hours, against a pedantic approach to studying tactics, and against simplification of tactics during flight operations and exercises. It is important to ensure that each and every commander, each and every pilot recognize himself as and in fact be a creator of tactics.

An innovative approach in flight activities increases the importance of process discipline and follow-through. In connection with the task of maximum utilization of the accuracy capabilities of today's aircraft systems, its role in the Air Forces has increased immeasurably. In view of this fact, a new classification of gross violations of equipment servicing and maintenance procedures has been adopted, and a system of measures to prevent such violations and to increase the general engineering and computer literacy of personnel has been devised. Attitudes toward this innovation have varied. In the military unit in which officer V. Malyshev serves as political worker, for example, they were quick to assess the importance of these measures and to explain their essence and content to aviation personnel promptly and in an easily understood manenr. They are already feeling results from the organizational and indoctrinational work which has been done. In those units and subunits, however, where less attention is being devoted to matters pertaining to strengthening process discipline and follow-through, improvement in qualitative indices of military labor is proceeding more slowly. Commanders, political workers, and party activists of these units must correct the situation without delay.

The process of reorientation of all Air Force cadres from extensive to intensive growth factors also needs strengthening of party influence. Practical experience shows that lengthening the workday, rush-work efforts, excessive work-loading, and unnecessary air and tactical situation simplification produce nothing but failure to adhere to proper training methods, violations of flight safety regulations, and a decline in people's productive and labor activeness. What is the solution? We believe that it lies in the ability of each commander to organize work time in a well-conceived manner, qualitatively to intensify working time to a maximum degree, and not only one's own working time but that of one's subordinates, and an effort to create in the unit an atmosphere of general search and aggressive implementation of internal reserve potential. A great deal here can be accomplished by resolute measures to ensure a high degree of instructiveness and a research nature to each and every training sortie and exercise, all-out development of military scientific work, and creative efforts by inventors and efficiency innovators. Political agencies and party organizations should arouse in pilots and navigators, engineers and technicians interest in everything which is new and progressive and should help them more boldly adopt innovations.

In discussing investigation of the training and indoctrination process, one should not ignore the matter of economy, for thrifty utilization of assets and resources is an essential condition for acceleration, both in the Air Forces and in the country as a whole. The units have amassed a fair amount of experience in successfuly achieving the targets of the USSR Food Program, in collecting materials containing valuable metals, and in extending the service life of aircraft engines. This know-how and experience must be made available to everybody and be actively transferred to other areas of economic activity.

The new tasks demand of leader-Communists and party organizations of Air Force scientific research establishments and higher educational institutions new approaches toward accomplishing them. Restructuring should be accomplished two or three times faster here, so that the activities of line units can rest upon a solid scientific foundation and be supported by a trained cadre reserve. It is important to concentrate the attention of the management and administrative machinery on giving effective assistance to commanders, political workers, party and Komsomol activists in accomplishing their assigned tasks. Recently attempts have been made to reduce the "paper flow" and to avoid unnecessarily taking people away from their work. But this is not enough. We must seek to obtain from all echelons of management and administrative party organizations greater output both from generators of progressive ideas and from leaders and organizers of combat and political training in the units.

A policy of intensification of combat training and acceleration of the pace of development in the Air Forces requires profound changes in party-political work, especially at the regimental and squadron levels. Today there is being felt a critical need to make it more specific, differentiated by personnel categories and tasks, and to raise work with individuals to the level of individual "honing" of moral-political, combat and professional qualities of military airmen. Specialist personnel of aviation engineering and other supporting services deserve more attention on the part of political workers, party and Komsomol organizations, since their tasks are becoming increasingly complex and increasing demands are being placed on them. It is necessary to act here in a well-thought-out manner, intelligently and, without usurping the functions of the various persons in authority, to influence by political methods, commanding respect and professional regard, the training of airmen to carry out bold, resolute and competent actions against any aggressor. Nobody is entitled to retreat from the campaign against everything which hinders accomplishment of the complex, critically important tasks which the party has assigned to military aviation personnel.

This demand also applies in full measure to restructuring of ideological work. It must be given an innovative character. We must boldly change everything which is not in conformity with the goals of acceleration and political indoctrination of personnel. The specific individual, the military collective, and the party organization should stand at the center of the ideological domain. It is high time to put an end to those measures which are random in form, primitive in content, unscientific, vague and unspecific, for some ideological workers have through such measures lost the ability to see specific individuals and orient themselves solely to the "masses." Hence there sometimes is deafness and blindness to the thoughts, interests, and needs of military aviation personnel and a weakening of feedback, which is so essential in ideological activities. Such a practice must be changed, proceeding not from measures but from man to measures with specific meaning, a clear goal, an audience, measures which place a positive imprint in servicemen's minds and hearts. There are no and should be no stereotype patterns and ready recipes in restructuring of organizational, ideological, and political indoctrination work. Inquiry, persistent labor, and Bolshevik refusal to be complacent are needed on the part of each and every individual.

The party considers increased militance by primary party organizations to be a most important direction and mandatory condition for restructuring. Recently a great deal has been accomplished in this regard. At the same time increased activeness by party organizations and their influence on the training and indoctrination process, flight safety, and strengthening of military discipline and order is proceeding intolerably slowly in a good many units. The primary party organization of the 1st Squadron of the aviation regiment in which Lt Col P. Bagin serves as political worker can serve as an example of this. The subunit's party buro and its secretary, Capt S. Skorobogatov, not only have failed to achieve changes in the direction of substantive and effective organizational work in decisive areas of the campaign to achieve a high degree of combat readiness and firm discipline, but have also lost the experience, know-how, and traditions amassed by their predecessors. An excessive attention to form with consequent detriment to content and separation of the party organization from the daily affairs of the military collective and its tasks have led to a situation whereby the squadron lost its leader position in a short period of time, and there have occurred instances of flight safety violations and other violations of regulations. And the subunit party buro secretary was one of the parties responsible for an air mishap.

Analysis of this and other facts ascertained in the course of inquiry indicates that direction of party work in this regiment failed to meet today's demands. Lt Col P. Bagin himself did not fully grasp the entire essence of restructuring, failed to improve his own work style, and did not demand this of his subordinates. For an entire year the political worker failed to find the time to visit that same 1st Squadron, listen to what party members had to say, and talk with the men. This is the result of replacing proper organization of things with bureaucratic methods of leadership which constitute nothing more than mere words of pronouncement. In this connection as well we should once again stress that in the process of restructuring, the party is advancing to the forefront matters pertaining to activating the human factor. Particular significance is taken on by the need to teach unity of word and deed and the habit of working with an eye to the future, focusing on excellent end results. In each collective it is essential to create an atmosphere of implacability toward those who merely talk about understanding their tasks but continue to act in the old way.

It was emphasized at the June (1986) Central Committee Plenum that there will be no profound restructuring if an atmosphere of intolerance toward shortcomings, stagnation, sham efficiency and idle talk is not established in party organizations. In the party collectives of Air Forces units and subunits it is necessary to strengthen a critical attitude in the spirit of the 27th CPSU Congress. Criticism should be frank and firm, precisely directed, revealing the causes of deficiencies, indicating ways to correct them, and supporting a healthy spirit of concern and refusal to rest on one's laurels. "We must move ahead, proceeding upward energetically and with a unity of will," urged V. I. Lenin. Today as well this Leninist demand and appeal are directed toward every military airman.

Guided by these demands and party instructions, as we enter the new training year it is essential to hold a firm course toward supporting everything which is in conformity with the decisions of the congress, which in fact means restructuring, movement forward. It is necessary to work more effectively, with an eye to the future.

3024
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FLYING NEW FIGHTER IN AIR INTERCEPT TRAINING SORTIES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 4-5

[Article, published under the heading "For a High Degree of Combat Readiness," by Military Pilot 2nd Class Maj B. Kononenko: "The Wingman Attacks First"]

[Text] It was a foggy morning. The only thing disturbing the silence was the noise of the motors of the service vehicles and the voices of aircraft technicians [crewchiefs] issuing brief instructions.

Emerging from the control tower, Military Pilot 1st Class Capt V. Alekseyev checked his watch. It was apparent that this officer was somewhat concerned: departure time wsa approaching, but the misty fog was refusing to dissipate. In addition, a thick haze could form at sunup, which would make it even more difficult to accomplish the mission. This meant an additional test for him, the element leader, just as it did, incidentally, for his wingmen as well, who were taking part for the first time in such an important tactical air exercise.

The command post team was also thinking about the forthcoming air combat. Communications gear and the operation of primary and backup equipment had been thoroughly checked, as had the controller team's readiness to perform the assigned task. Tactical control officer Sr Lt A. Yurkin had made the necessary calculations in advance.

At sunrise the fog began to thin, and soon had entirely dissipated. Haze developed, however. But the time was upon them. Green flares shot skyward -- the signal to commence the flight operations shift. As soon as element leader Captain Alekseyev keyed his mike and reported ready, the command post team went to work with this two-aircraft element of combat jets. The time display flashed on, and the radar scan proceeded patiently sweeping the plan position indicator display. One sweep, a second sweep, and the screen filled with "ground clutter." It is no easy matter to distinguish a target return amidst this clutter. But this did not confuse officer Yurkin, for he had acquired a sure eye. In one of the PPI sectors, practically at the outer edge, Aleksandr spotted a silverish pip. Pointing to it, he stated: "There's the target. As soon as the blip reaches this point," he traced a dashed line on the display with his pencil, "we'll scramble the two fighters."

Upon receiving the command to scramble, the pilots fired up their engines and taxied out to the active. They held briefly in position, and then, on command by the flight operations officer, they lit their afterburners. They commenced their takeoff roll. Picking up speed, the combat jets lifted off the concrete runway. They became enveloped in a thick, bluish haze. It was not solid instrument weather, nor was it really VFR.

The aircraft proceeded wingtip to wingtip, as they say. Their returns on the PPI practically merged into a single blip. Senior Lieutenant Yurkin radioed instructions to the element leader.

Instructed to alter the flight configuration, Captain Alekseyev realized that the air-to-air combat would take place at medium altitude. During their premission preparations, he and Capt Ye. Grek had worked out to the tiniest details different variations and modes of attacking the target. Now a single word and maneuver were sufficient for the wingman to grasp what his leader was intending to do. The aircraft were positioned toward the sun in such a manner that it was blinding the wingman. The pilot immediately adjusted formation. He radioed: "To your right, in position."

The pilots switched on their radars. A target return was clearly visible on the weapon radar display. And they could see out ahead and at a higher altitude the twin contrails produced by the target aircraft. The best possible airborne reference point. The pilots proceeded to maneuver for the attack. "We shall attack simultaneously!" Captain Alekseyev informed his wingman.

At this point the higher-echelon commander, who was present at the command post, gave a scenario instruction: "The element leader has lost communications with the command post and his wingman."

Alekseyev had faced such a situation more than once. But in this instance the scenario instruction was more for Captain Grek, who at the most critical moment of the attack would be initiating the action. The complicated element was the fact that the aircraft had already reached optimal range to the target. Every second counted....

The wingman accomplished the mission with flying colors. Drifting laterally until clearing the element leader, he moved out to lead position and reported a few seconds later: "Missile away!"

Then, skillfully maneuvering, he created conditions for Captain Alekseyev to engage the "adversary" in maneuvering combat at any moment, without losing visual contact with the element leader.

But this was not to be. The command post retargeted the element to a low-altitude target.

The pilots quickly reestablished formation.

When the fighters entered the haze, the wingman "eased in" close enough so as not to lose sight of the leader. At the same time he made sure he was maintaining freedom to maneuver.

...The "enemy" was aggressively penetrating through toward his target. Aware that the ground radar crews were busy with a high-altitude target, he was counting on slipping through undetected. He did, however, continue the precaution of continuously maneuvering to confuse any possible pursuers.

Target designation instructions from the command post enabled Captains Alekseyev and Grek to determine that the "adversary" was experienced and would not be easy to defeat. This time the pilots would have to find him and close without outside assistance, culminating the attack with a burst of cannon fire.

They were prepared for such a turn of events. Working out air-to-air combat in detail back on the ground, they had devised a procedure which would enable them to remain undetected while approaching the target, ensuring the element of surprise. It required spotting the target visually, against the background of the ground surface. The pilots peered intently out ahead. But the haze concealed the "adversary."

Suddenly an aircraft executing a turn appeared below and to the right of the wingman. The fighter pilots' calculations had proven correct!

Executing a maneuver, the aircraft split and, taking up a tactically advantageous position, attacked the target one following the other. Once again the situation was such that Captain Grek was the first to attack. When the "adversary" spotted the approaching fighter, he maneuvered in an attempt to thwart the interceptor's attack pass. The maneuver was unsuccessful, and he found himself in a seriously-exposed position. The wingman scored a sure kill.

The pilots streaked over the field, broke formation, and commenced the landing approach. The jets executed a flawless landing. First-rate combat pilots Capts Vladimir Alekseyev and Yevgeniy Grek had done an excellent job of accomplishing a difficult, critical mission.

* * *

(The following are comments on the performance of military pilots Capts V. Alekseyev and Ye. Grek by Maj Gen Avn E. Shubin, chief of staff of air forces of the Red-Banner Transcaucasus Military District.)

The concluding period of a training year is a time of maximum-intensity, difficult flight operations. A graphic example of this is the mock air-to-air engagement flown by a two-aircraft element led by Capt V. Alekseyev during a tactical air exercise. These officers had quite recently completed conversion training on a new aircraft, but they performed like veteran combat pilots.

According to the documents governing flight operations, the element leader bears responsibility for successful mission accomplishment and the element's flight safety. It is his job continuously to direct his wingmen, from initial taxi to landing, to monitor his men's actions, to be familiar with and assess the air and weather situation, to make specific decisions, and to execute them promptly and in a competent manner, taking flight safety into consideration.

In these instances a wingman becomes an agency executing the tactical plans of his element leader. The experience of combat operations during the Great Patriotic War and present-day training flights indicates, however, that frequently the wingman's role is not limited to merely copying the actions of his element leader. This means that the following demand is primary for each and every pilot in the element: he must be ready at all times to engage in independent actions, to take the initiative and assume full responsibility for successful accomplishment of the assigned mission.

A two-fighter element has been aptly compared to a sword and shield: the leader attacks, while the wingman provides protective cover. This formula was derived by wartime combat fliers, when a flight leader depended on sure cover by his wingman. But aircraft have experienced considerable changes since that time. This unquestionably could not help but increase the role played by each pilot in an element, which was fully confirmed in the case in question.

The experience of tactical air exercises conducted in an environment maximally approximating actual combat convinces us that such qualities as independence, combat daring, resourcefulness, and faith in one's own ability are essential to every flier. The tactical device of the wingman attacking first is not new, but it is highly effective. It should therefore be rehearsed on a regular basis.

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HELICOPTERS FLY CLOSE-SUPPORT AIRSTRIKES IN TACTICAL EXERCISE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 8-9

[Article, published under the heading "For a High Degree of Combat Readiness," by Capt A. Popov: "Tactical Air Exercise: Pluses and Minuses"; first two paragraphs are AVIATSIYA I KOSMONAVTIKA introduction]

[Text] A tactical air exercise was held in the rotary-wing squadron under the command of Maj V. Vyakhirev. Aircrews were tasked with working in coordination with ground subunits. The helicopter crewmen displayed excellent combat proficiency, but their performance was not entirely mistake-free.

Military Pilot 1st Class Lt Col A. Zolotarev provides commentary on the performance of the helicopter crews at the tactical air exercise.

Optimal Solution

Helicopter squadron commander Maj V. Vyakhirev, spreading out a large-scale map, analyzed the current tactical situation. It was complicated, indicated by the fact that the line of contact between the opposing forces twisted snakelike across the map. The "Northern" force, engaging fresh subunits from its reserve, had halted the advance of the attacking force and had shifted to a defense disposed in depth. Intelligence had also reported that the "enemy" was redeploying his forces, preparing to launch a powerful counterthurst.

In this situation the "Southern" force command decided to beat the "enemy" to the punch, to break through his defense and dig in on the east bank of the river. The helicopters were to support the advance of the motorized riflemen and tanks.

Closely analyzing available information, Major Vyakhirev reached the conclusion that the squadron should redeploy to another, tactically more advantageous airfield, while some of the helicopters should be deployed to a staging point near the front lines. Col N. Churkin, who was directing the exercise, voiced approval of the squadron commander's plan, since this move would enable aircrews to hit the "enemy's" forward positions on timetable and with less risk.

It was decided to redeploy to the mission area with two elements: an air and a ground element. Transport and communications teams were formed for this purpose, tasked with supporting combat operations, command and control of subunits at the alternate airfield and staging point.

The helicopters took off on schedule. Aircraft flew low and maintained radio silence. This required good mutual understanding and coordinated actions on the part of the aircrews. A weather reconnaissance helicopter, under the command of officer A. Zakharov, flew at a specified distance out ahead of the main body. This helicopter also carried a preliminary reconnaissance team led by Maj N. Pleskachov, tasked with assessing the possibility of landing in an area of limited size, as well as with receiving helicopter gunships at the site.

When the helicopters had arrived safely in the destination area, the exercise director handed Major Vyakhirev the operation order. Upon reading it, the squadron commander realized that the operational plan worked out in advance had to be substantially revised, since the situation had changed. But they were working on a tight timetable. In order to save time, the squadron commander decided to use the parallel method of preparing to execute the assigned mission. It consisted essentially in the following: warning orders were issued without delay to the rotary-wing sections. Thus all aircrews took part in working out alternative plans. We should note that this method not only shortens preparation time but also improves quality and forces airmen to act with initiative, looking for optimal solutions on their own, rather than waiting for instructions from the higher echelon.

While the airmen prepared for flight operations, Maj N. Pleskachov, the executive officer, prepared the necessary data for the commanding officer to make his final plan decision, and drew up a combat sortie schedule. The squadron commander, together with the command agencies of the ground subunits, detailed the specifics on areas and timetable of joint operations, strike targets, manner and procedure of target marking and terrain illumination, sequence of helicopter passage over the motorized riflemen's positions, signals to mark the line of contact, as well as manner and procedure of target designation. The section commanders made adjustments in their plans and communicated situation changes to their men.

Commentary: On the whole preparation of helicopter crews was done correctly, and considerable credit for this goes to Major Vyakhirev. The squadron commander went into excessive detail, however, on the manner and procedure of performing combat missions, which limited the independence and initiative of his aircrews. The explanatory report and target descriptions were not fully worked up. The commander's plan ignored such important items as retargeting aircrews, status of and description of "hostile" air defense assets. In actual combat such an excessive situation simplification would be fraught with rather unpleasant consequences.

The tactical air exercise also demonstrated that in order to shorten the time required to prepare a subunit for combat operations it is essential to have several plan variations for executing standard missions, taking into account weather and the factor of daylight or darkness.

In Close Contact

Major Vyakhirev knew from the experience of previous exercises that his men's success in the forthcoming battle would depend in large measure on how solidly they arranged coordination with ground subunits. For this reason the squadron commander devoted particular attention to this problem. On the eve of decisive events the squadron commander and his executive officer met with the commanding officer of the combined-arms subunit and the range officer of the artillery battery working in coordination with the supporting air. The officers detailed the rate and direction of fire, height and trajectory of artillery projectiles, commencement and end of burning of parachute flares.

During hours of darkness it was decided to illuminate targets with two battery salvos with a rate of fire of 25-30 seconds, which would enable aircraft to work effectively. In addition, reference points and forward air controller location were determined jointly. All this information was subsequently communicated to aircrews.

Airstrike delivery on targets illuminated by ground troops assets is without question a very complicated task. It requires precise calculation and complete mutual understanding on the part of both parties. Major Vyakhirev clearly understood this fact, and therefore in order to ensure reliability he decided to run two helicopter strike elements firing missiles and rockets.

As soon as dusk had fallen, green flares shot skyward over the airfield. Several minutes later helicopters proceeded to take off in pairs. The first to depart was an element led by Military Pilot 1st Class Maj A. Podyablonskiy. In order to utilize target illumination time most efficiently, the element leader decided to deliver strikes by single helicopters stringing to the target at predetermined forward spacings. The plan succeeded. The "enemy" became flustered. Exploiting his confusion, the pair of helicopters flown by Capts A. Tupikin and A. Novochenko, formed in echelon right, also delivered an accurate rocket strike. A good job was also done by other helicopters, flown by officers K. Kustovskiy, N. Mayorov, N. Lukin, and A. Gritsenko.

At this point we should mention the role played by the forward air controller, who issued precise commands to the battery range officer.

Commentary: Although the first airstrike on the "enemy" was successful, nevertheless there were serious deficiencies in coordination. For example, due to lack of experience in firing illuminating shells, the gun crews were unable to deliver on the scheduled procedure of illumination, which made things difficult for the aircrews. An additional difficulty was caused by deteriorating weather. Some aircrews had difficulty spotting their targets.

As practical experience indicates, optimal conditions for spotting targets are to be found at a height of 100-150 meters above the target or 50 meters beyond it. It is therefore advisable, when calculating the point at which to give the command to illuminate, to take into account the time during which parachute flares will be descending from a height of 500 to 200 meters, that is, by the moment a helicopter approaches to the specified range. The command to illuminate line should be designated with a marker light. Experience indicates that maximum airstrike effect is achieved when the target is simultaneously illuminated and designated by machinegun tracer trajectories. Illumination must be provided for each two-ship element or flight of helicopters on its weapons delivery pass.

It was ascertained during the tactical air exercise that organization of coordination between air and artillery subunits presents certain difficulties. Therefore, in order to hold precisely to the illumination schedule and ensure a safe firing interval, an airman should definitely be assigned to assist the range officer. At night target designation was performed by firing machinegun tracer rounds on commands given by a forward air controller positioned in the platoon commander's infantry fighting vehicle. Detecting targets lacking infrared contrast, however, presented considerable difficulty both for the forward air controller and for the machinegun crews. Hence the conclusion that a forward air controller should be provided with night-vision devices.

Counting on Skill

Maj V. Vyakhirev, gathering together his section commanders, gave them final instructions just prior to the second attack. Just when it seemed that all items were clear, an umpire walked up to the squadron commander and handed him a packet. The enclosed document stated that the artillery battery providing illumination of targets had been "destroyed." This meant that the helicopter crews would have to use their own resources. This presented the squadron commander with quite a problem, but he did not become flustered.

Briefly explaining the situation to his men, Major Vyakhirev said: "Under the circumstances I consider it advisable to hit the targets in three groups. We shall provide our own illumination of the target areas -- with rockets...."

The officer then presented a detailed plan of action.

...Soon the helicopters took off on command from the command post. The first element was led by Military Pilot 1st Class Maj V. Zdrevtsov. A great deal depended on this element's actions. For this reason the aircrews endeavored to be as alert as possible. Incidentally, this was also required by the complicated formation in which they flew to the range.

At a specified distance short of the targets the leader proceeded to vary his airspeed and altitude, alerting his wingmen to this with a prearranged signal. The crew of the helicopter piloted by Capt S. Gerasimov, designated to illuminate the targets, fired a rocket salvo. The second aircrew followed suit at the designated time interval. This procedure ensured overlapping target illumination. The "enemy's" equipment was clearly visible. A precision airstrike was delivered.

When the illumination provided by the rockets died out, other aircrews swung into action. They performed with equal success. Pilots Capts K. Kustovskiy and N. Mayorov fired a rocket salvo, and then attacked the range targets. They scored accurate hits. The aircrew led by Maj A. Podyablonskiy also successfully accomplished the mission.

Thus thanks to a high degree of proficiency, the airmen succeeded in coping with a difficult situation in a creditable manner.

Commentary: The second run showed that when firing illuminating rockets it is essential to pay greater heed to corrections for wind velocity and direction. One corrects for a tailwind or headwind by initiating maneuver earlier or later, and for a crosswind by turning toward the target by two thirds of the drift angle (US) from the magnetic heading maintained on the weapons delivery run taking drift angle into account.

With the Forward Air Controller's Assistance

During the tactical air exercise target designation was provided not only by a ground forward air controller but also with the assistance of aircrews. With guidance provided by a target designator helicopter, strike aircraft would be guided into a position ensuring successful target detection and strike by issuing commands to alter heading, altitude, and airspeed. During the guidance process the target designator helicopter would take an advantageous position for observing both the ground and air situation, which enabled the aircraft commander, officer N. Churkin, to observe both helicopters and targets without impeding maneuver by the strike aircraft.

In addition to guidance commands, the airborne FAC would also radio information on the nature of targets and their displacement in relation to predetermined reference points. The strike element leader would report spotting a target to the target designator helicopter pilot and would attack on the latter's command.

When guiding helicopters to the target in daylight, the target designator helicopter would rendezvous with the strike element as they approached a preselected enemy position. At a specified range to the target, the pilot would give the appropriate command by maneuvering his aircraft and would lead the strike element to a target spotting position.

Such guidance by leading would be performed in conditions of complete radio silence. Upon approaching the target, the target designator helicopter would swing away, clearing the target run for the strike element and diverting the "enemy."

Commentary: Target designation becomes particularly important when combat operations are conducted in conditions of limited visibility over unfamiliar terrain containing few landmarks. Analysis of the results of the tactical air exercise indicates that a persistent, innovative search for new tactics is occurring in the squadron. Personnel are seeking to increase the effectiveness of helicopter combat employment. But aircrews must be trained and prepared in advance for target designation. To accomplish this it is apparently necessary to think about devising special methods.

...A new training year will soon be upon us. Helicopter crews are faced with large, difficult tasks to accomplish. This tactical air exercise showed that there is plenty of work to do. The end result of their military labor will depend in large measure on the pace airmen take henceforth in combat training.

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HELICOPTER PILOTS NEGLECT PREFLIGHT INSPECTION, EQUIPMENT CHECK-OUT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) p 13

[Article, published under the heading "For a High Degree of Combat Readiness," by Military Pilot 1st Class Maj A. Aleksandrov: "Is Solely the Technician to Blame?"]

[Text] Flight operations were in progress. Helicopters were taking off one after the other and heading out on a training flight. Suddenly one helicopter commenced a landing approach instead of continuing its climbout to the assigned altitude. Ground crewmen rushed over toward it.

The pilot, Capt F. Buntar, informed them that failure of a radio had caused him to turn back. It was subsequently ascertained that the radio failure had been caused by moisture getting into an electrical connector. Upon being told the cause, the pilot was indignant: "Just what were you looking at when you preflighted my helicopter? Because of you my crew was unable to perform an assigned training mission," the officer complained to the avionics servicing people....

At first glance this appeared logical. The pilot's indignation was understandable. But then the regimental commander walked up to the airmen. After listening attentively to Captain Buntar's report, the colonel stated: "Don't look for a scapegoat. You are just as much to blame as the technician. You should have completely checked out your radio gear prior to takeoff, and only then taken off. Incidentally, this is what regulations require. You are no novice to aviation and should know that."

The situation was rather complicated. On the one hand the blame on the avionics people and the flight technician [crew chief] was obvious. They had been slipshod in preparing the equipment in question and had failed to notice a problem with the radio. But what about the pilot?

Prior to departure it was his obligation to check the condition and status of all systems and equipment and personally to determine that they were in good working order. The fact is, however, that Captain Buntar simply ignored the requirements of the appropriate regulation. This means that he also bore direct blame for the incident. Multiple-stage checking and inspection in aviation exists for the purpose of avoiding such incidents.

Unfortunately we must note that such things occur fairly frequently with helicopter aircrews. And all because some pilots adopt what is, quite frankly, a faulty principle: our job is to fly, and preflighting the aircraft is the concern of ground personnel. By shifting the entire responsibility for the equipment being in good working order over to technical personnel, they are essentially keeping aloof from preflight inspection of their helicopter and placing themselves in the status of some kind of "elite pilots," who consider painstaking inspection of the aircraft to be beneath their dignity. This does not go unpunished.

I recall the following incident. Two helicopter crews were to operate out of a field staging site. When they arrived at the site the situation required that they immediately go out on a weapons delivery sortie. Within a few minutes the crew, consisting of pilots N. Kharitonov, Lt S. Salikov, and flight technician Sr Lt O. Aksenov, had serviced the craft and were airborne. But the pilots of another helicopter, Sr Lt Yu. Boryakov and Lt V. Rusak, had totally handed over preparation of their helicopter to the flight technician, WO Ya. Yastrubko. As a result their departure was greatly delayed, and in the final analysis they failed to accomplish the mission. This is the cost of a lack of mutual assistance among the members of an aircrew!

Modern helicopters carry highly complex equipment. The fact of a great many units, assemblies, and gauges obliges pilots rigorously to assess their operating status and condition prior to a flight. Of course this does not mean that one should have no trust or confidence in ground maintenance personnel. Most of them are conscientous, technically proficient individuals, but it is no secret that various circumstances can cause even experienced technicians to make mistakes. The procedure of the pilot's preflight inspection exists precisely for this reason. As they say, trust, but also verify.

I should note that this principle is unwaveringly observed in fighter and bomber subunits. Apparently one of the reasons for this is the fact that the aircraft technician remains on the ground after approving his aircraft for flight. We have a situation where any mistake he might make is irreparable and could cost the pilot dearly. Therefore the military pilot carefully inspects his aircraft before going up in it.

Things are different with helicopter crews. Since the flight technician is a member of the aircrew, some helicopter pilots are rather casual at times about the process of handing over the aircraft by ground personnel. Their attitude is that if anything happens, the flight technician will come to the rescue and correct the malfunction. Such a careless attitude can ultimately lead to an unpleasant incident, since the flight technician is not always able to correct a malfunction in the air. The following offers confirmation of this point.

Departing for the range, Sr Lt S. Lyatov did a precise job of penetrating "hostile" air defense and was properly positioned for his target run. But at the most inappropriate moment his sight malfunctioned. He accomplished the mission with great difficulty.

Unquestionably the aircraft armament maintenance people were to blame. It was their job thoroughly to check out weapon sight operation on the ground. They had figured, however, that since it had operated normally during the preceding training sortie, it would continue to do so on this flight. Nor did the flight technician, Sr Lt V. Tryasoguz, properly check the job done by the armament people. The last link in the chain of inspection and verification remained -- the pilot. But this link also failed and, once airborne, the flight technician was simply powerless to correct the malfunction.

Analyzing such incidents, one cannot help but ask: Why is it that they still occur in military aviation?

That is not an easy question to answer. Personnel in the subunits sometimes fail to observe the elementary requirements of documents governing flight operations. Pilots go through the motions of receiving their helicopters from the ground maintenance people, but the aircraft commander, failing to follow the rules regarding receiving and inspecting his aircraft, encourages development -- without even realizing it -- of a lack of responsibility on the part of his flight technician for the quality and completeness of preflight preparation of the aircraft. This in turn has a highly injurious effect on creating an atmosphere of mutual demandingness in the squadron.

Sometimes pilots, attempting to justify their careless, negligent attitude, complain that flight operations schedules are extremely tight and that an aircraft commander has no time to inspect his helicopter. I am convinced that this is nothing but an excuse. If we assume that it is, one cannot help but note the obvious: prior to takeoff an aircrew is supposed to run up the engines and go through a systems checklist. Time is always allocated for this. Can one ignore this requirement? Of course not.

I should also like to emphasize the following. Whenever any malfunctions or failures occur, commanders of air subunits, defending the "honor of the uniform," hasten to put the entire blame on ground maintenance personnel. But they forget about calling the pilot to account for being remiss. I feel that this is not quite right. In military aviation all personnel procedures are described and spelled out in detail. This means that it is necessary more strictly to monitor adherence to regulations by all aviation personnel, regardless of their position. In my opinion responsibility for failure to accomplish a mission should be borne primarily by the pilot in command. This will make it possible considerably to raise the level of self-discipline on the part of flight personnel prior to taking off on a training sortie.

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RECENTLY-GRADUATED FIGHTER PILOTS ANALYZE PERFORMANCE IN FIRST YEAR IN LINE UNIT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 14-17

[Round-table discussion, published under the heading "Problems of Development of Young Officers," compiled by Lt Col V. Larin: "Year of Study -- Year of Maturing"; first four paragraphs are AVIATSIYA I KOSMONAVTIKA introduction]

[Text] A field staff of the journal AVIATSIYA I KOSMONAVTIKA conducted a round-table discussion in a twice-decorated guards aviation regiment.

One year ago young officers -- graduates of higher military aviation schools for pilots -- arrived at this guards fighter regiment. Their initial development took place during the period of preparation for the 27th CPSU Congress and the early phases of the campaign to implement congress decisions and restructuring of organizational, ideological, and political indoctrination work.

Practical adoption of new organizational forms of combat training, including flight training, and increased responsibility for the quality of the training and indoctrination process demanded hard work on the part of commanders, political workers, party and Komsomol organizations, as well as innovative search for the most effective ways and methods of resolving the problems of development of young officers.

A businesslike, detailed discussion was held on the results of the work performed during this past year and the lessons learned, in the course of a round-table discussion. Participants included Gds Lts S. Baluyev, V. Verchenko, N. Ivanov, Yu. Ivanenko, and O. Lazarev.

(Gds Lt N. Ivanov):

We were faced with an important task during this past training year: to complete the training program with excellent quality and to obtain the military pilot 3rd class rating. Most of my comrades successfully accomplished this task. For example, Gds Lts O. Vdovin, N. Dyachenko, V. Kapshin, and B. Lomakov were the first to complete the program, ahead of schedule. Soon others achieved equal success. Only Gds Lts N. Bashlykov and A. Malnikov failed to meet the timetable.

Are we satisfied with the results of our training? It is hard to give a single answer, for each of us accomplished some things better and some things worse. On the whole, however, looking at our work accomplishment objectively, one can state that we could have accomplished more.

(Correspondent):

On the eve of our round-table discussion I talked with the regimental commander, his deputy for political affairs, the chief of staff, and your squadron commanders Gds Majs V. Kovalev and A. Kireyev. The unit command authorities and party committee believe that all necessary conditions were created for the young pilots, from quarters to a "personal" aircraft for a flight operations shift, to accomplish effective training and improved flying and command skills. All of you had things approximately the same. How does one explain the difference in the time it took to prepare for earning the rating?

(Gds Lt O. Lazarev):

As I see it, a differing level of flying skills and theoretical preparation achieved at service school was a determining factor. The phased timetable for breaking in the new pilots was drawn up taking this into account, as well as the fact that some of the young pilots had to conversion-train over to a different fighter.

End results of training and socialist competition were also affected by the young pilots' attitude toward training classes, mastering the training program, and their psychological mindset. Nikolay Ivanov stated that the performance results of this most recent period of flying and commander development of the young officers could have been better. I feel that this was hindered by an unwarranted welter of activities during our first days with the regiment. Nobody can be accused of lack of effort, but the manifestation of effort varies. Why is it, for example, that Dyachenko and Vdovin are always at the forefront in quality of flying proficiency and success in training performance? It is because both of them focus their attention and energies on the job at hand. Organization and inner self-discipline, reinforced by good preparation for each training sortie, help them achieve the stated objective.

(Gds Lt S. Baluyev):

Lazarev correctly noted that a great deal depends on us ourselves. I, for example, thought that the knowledge and skills obtained at service school were entirely adequate for commencing duty in a line unit. It turned out, however, that it is not enough to have general knowledge of a subject; depth and specificity in each item are required. Things were difficult at first, when inertia of thinking and overrating of one's knowledge and skills had an effect. I don't know about the others, but I frequently had feelings of confusion and lack of confidence in myself, which unquestionably affected my preparation for training flights and my performance in the air. This feeling went away with time, but it did reflect in some measure on training performance results.

(Gds Lt Yu. Ivanenko):

I also experienced similar feelings, especially after failing to do well on tests on aircraft design and operation. Many of us had to get together with the engineers more than once. Why was this? Because during the training process the majority of us did not approach with sufficient seriousness the tests for certification to fly, apparently figuring that they would make it easier for us since we were novice pilots. But as much was demanded of us as of any combat pilot. Many of us, including me, did not immediately grasp this difference in approach to grading knowledge and level of flying and commander proficiency.

I should like to take this opportunity to pass on some friendly advice to cadets in their last year at pilot school: they should realize that from their very first day in a combat unit their entire daily life and training will be subordinated primarily to the interests of combat readiness, and the demands made of them will be determined by the measure of combat. I would like to emphasize once again that restructuring of one's consciousness is not easy for everybody. For this reason it is important psychologically to prepare oneself in advance for the tougher and more specific requirements of combat training from the very first day in a line unit.

(Correspondent):

It is becoming clear from our discussion that a psychological restructuring, if I may put it in these terms, from school to combat orientation has had a substantial effect on the training time required by young pilots and the quality of training performance. But did not other problems also arise in the process of your development as a pilot and a commander?

(Gds Lt V. Virchenko):

Yes, of course. For example, our common shortcoming lies in an inability really to work independently even in scheduled training classes. Strange as it may sound, many of us at first were unable efficiently to distribute our time, to prepare everything needed for training classes without outside help, and to work with the instructional literature in a methodologically competent manner. Frequently after assignments were made, the lieutenants would proceed to besiege their superiors with questions: where should they go for one thing or another, and how should some other thing be done? And they failed to see anything bad in this: it was the normal working environment; after all, they are concerning themselves not with extraneous matters but with preparation for classes.

Modern forms and methods of organization of combat training, which are also employed in our regiment, prescribe maximum concentration of people's time and efforts in the process of preparation and solving specific problems and require a great deal of independence and initiative. But what is the situation in our regiment? Not all of us adequately knew how to work and economically to expend our own time and that of others. Let us say that a flight commander has three hours at his disposal immediately prior to the commencement of a flight operations shift. He must do his own preparations, help each of his men prepare, test their knowledge, and leave some time for various unforeseen circumstances. Let us say, for example, that I have some questions or organizational problems and the flight commander had to spend 10 minutes just on me. Then Ivanov, Lazarev, and Ivanenko go to him with their problems. A great deal of time has been spent, but we have not yet actually started work. This unquestionably has an adverse effect on the quality of preparation for flight operations.

(Gds Lt O. Lazarev):

I agree with Virchenko. But it seems to me that it is important here to note the significance of work being done on developing independence in the process of one's development as a combat pilot, for many of the shortcomings he mentioned were manifested in the air. A habit of prompting and excessively close supervision caused excessive tenseness in the air and constrained initiative. What were the most common adverse comments about us from the instructors? Repeating mistakes in flying technique, poor independence, and lack of initiative. In my opinion this past training year has greatly helped us understand what qualities are especially needed by a fighter pilot, which each of us is still lacking and on which we must work.

I feel that it is particularly important to become permeated with a warrior spirit, to understand and fully to sense one's principal function. I do not exaggerate what we have achieved, but I would like to say that the work done by commanders, the party and Komsomol organizations in this direction was not in vain, and that earning that rating truly confirms the professional readiness of young pilots to engage in combat operations. Increased flying skills and psychological toughening are indicated by instances when my comrades did a good job of coming out of difficult situations in the air. For example, while on a training flight in the outer practice area, the radios went out on Gds Lt N. Ivanov's aircraft. Nikolay did not lose his composure, responded with precision and strictly according to the book, and landed safely back at our field.

I should note that our airmen's entire daily lives, work and training are permeated with a warrior spirit. This regiment has fine combat traditions. There are worthy examples to emulate. 18 combat pilots were awarded the title Hero of the Soviet Union during the Great Patriotic War. Today the unit also contains many genuine experts at air-to-air combat. They include our sensitive, caring mentors Gds Lt Col V. Ruman, Gds Maj A. Kireyev, Gds Capts A. Ananyev, M. Lyashenko, and others. We learn from the war heroes and our commanders to use an effective combination of fire and maneuver, combat daring, and guards aggressiveness.

(Gds Lt V. Virchenko):

Development of warrior qualities, just as the other problems of development of young pilots, are constantly at the focus of attention of the party and

Komsomol organizations. The members of the party committee and experienced party activists have greatly helped me, as party group organizer, in my efforts to ensure personal exemplariness by young party members in combat training and performance of duty and in increasing their aggressive innovativeness. Party influence has extended to each and every young officer. Not one single instance of poor preparation for flight operations has been ignored by party members.

Holding to account has most frequently been supplemented by practical assistance. For example, when Dyachenko and his comrades were the first to pass the tests for their rating, the party buro asked them to help their comrades. A collective exchange of experience and know-how as well as individual patronship enabled us to avoid some mistakes and to feel much more confident in mastering new maneuvers.

I recall the following incident. Nikolay Ivanov, who up to this point had successfully completed the flight training program, was having trouble performing smoothly in mastering IFR flying under the hood. He had good skills, and he had prepared conscientiously for the flight activities. What was the problem?

At performance critique and analysis sessions, and subsequently at a party meeting, when discussing how the young pilots' training was coming along, this matter was brought up. With the help of experienced methods specialists and indoctrinators party members V. Ruman and A. Kireyev and, of course, N. Ivanov himself, they succeeded in getting to the reason behind his mistakes. It seems that in the absence of his flight commander, who was away on a temporary duty assignment, the squadron commander began flying with Nikolay. The natural desire of a subordinate to do a good job resulted in excessive tenseness and constrained movements.

Analysis of this incident and other errors by young pilots connected with inadequate psychological stableness enabled party activists, working together with the command authorities, to specify measures to improve individual indoctrination work and to strengthen party monitoring and accountability by party members for the quality of general and specialized training drills and moral-psychological training activities.

The endeavor to resolve jointly, on a party foundation, all matters pertaining to training and indoctrination and to teach people first and foremost on the basis of positive know-how and experience, and to correct deficiencies at an early stage in their development -- in my opinion all these things also helped achieve the results with which we ended this past training year.

(Correspondent):

In your opinion, have you formed a genuine military collective, and does everybody correctly understand the feeling of collectivism?

(Gds Lt V. Virchenko):

Our process of development is continuing, and so is the process of forming of a collective. We are unified by the striving to fly better and more rapidly to acquire warrior qualities, as well as the common goals and tasks of flight and commander training at the present stage of combat training. It is probably premature, however, to state that an atmosphere of mutual demandingness and party firmness has become firmly established in our collective. At times some young officers fail to have a precise understanding of their obligations to the collective and to their comrades. Take, for example, an incident involving Lt O. Pavlov.

Oleg had experienced serious difficulties in flight training since his first days in the unit. In spite of all the efforts of his superiors, things were not going well for him. Finally Pavlov asked to be assigned to aircraft with dual controls. Only after this was it ascertained that Oleg's comrades at service school had known about his poor level of flying proficiency but had remained silent. Their attitude was: let our superiors figure it out for themselves. They did, but this required considerable time, effort, and resources.

Leveling severe criticism against manifestations of a false sense of comradeship, the command authorities and party organization pointed to the outright harm from such actions, including for us, for the wasted labor of many individuals, the expended fuel and aircraft hours logged could have sped up preparation of the young pilots to earn their rating.

This incident unquestionably served as a good moral lesson for me and the other lieutenants, forcing us to give greater thought to our actions and to place them in conformity with the interests of the collective and the common cause. Now, during preparations for the new training year, each of us is endeavoring to work with greater responsibility and greater results. And this will help us get through the next stage of development as a pilot and commander more confidently and with better results. We have the right attitude, and we shall endeavor to confirm this fact with specific deeds.

* * *

In summarizing the results of this get-together with young pilots of a guards fighter regiment in a round-table discussion with AVIATSIYA I KOSMONAVTIKA, we should stress that the unit's command authorities and party committee on the whole give high marks to the quality of performance of the tasks assigned to the recent pilot school graduates during the past training year. One important result achieved during this recent period of these officers' development is their genuine readiness to perform combat activities to the extent of the tasks specified by the training program, a higher level of ideological-political and moral-psychological conditioning, tactical thinking, flying and command skills. All young officers received practical party or Komsomol work experience, making a definite contribution toward indoctrinating personnel in the heroic traditions of the Air Forces and the guards regiment, toward strengthening military discipline and the cohesiveness of the collective, and in improving mass cultural and sports activities. They showed an appreciable increase in personal responsibility for the quality of ground training, accomplishment of assigned tasks in the air, flight safety, and for the success both of themselves and their fellow officers.

At the same time, in creating favorable conditions for the development of these young pilots, the regimental command authorities were entitled to expect better end results. The rate of improvement and qualitative combat and political training performance results, however, were below expectations in the case of some of these officers. Reasons for this included deficiencies in the flight training of a few of the service school graduates, which required additional time and efforts to correct, and a lack of psychological preparedness for the demands imposed on the combat pilot. A typical common deficiency for most of the young pilots was a poor degree of independence and initiative, being accustomed to excessively close supervision and help both on the ground and in the air. The unit's command authorities also note that the character references and efficiency reports on the pilot school graduates fail adequately to reflect the strong and particularly the weak points in flight and moral-psychological training, which makes it harder to study the individual qualities of the young officers and affects how long it takes to break them in.

I believe that this round-table discussion will be of benefit not only to the participants but will also help in the development of other young pilots and will enable pilot cadets, faculty and flight instructors at pilot schools consider the experience, mistakes, suggestions and advice presented by the participants in this get-together and by their superiors, for the present stage of development of the Air Forces demands a qualitatively new level of knowledge and professional competence on the part of cadres, as well as a new way of thinking and new approaches to accomplishment of the tasks for military aviation personnel proceeding from the decisions of the 27th CPSU Congress. The quality of accomplishment of these tasks and the future for the Air Forces will depend in large measure on those who have just begun or who are about to begin service in Air Force units and subunits.

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LANDING Mi-2, Mi-8 ON MOUNTAIN-AND-DESERT TERRAIN

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 18-21

[Article, published under the heading "Practical Aerodynamics for the Pilot," by Military Pilot 1st Class Lt Col A. Trotsyuk: "Like a Fixed-Wing Aircraft on Mountain-and-Desert Terrain"]

[Text] A helicopter takeoff from and landing on unimproved sites on mountain-and-desert terrain possess specific features determined by the underlying surface. When there is little or no grass cover, for example, a great deal of dust is churned up even with throttled-back engines. When landing on such sites using helicopter procedures, one must "hover" for some time at a height of up to 10 meters in order to blow away the dust and ensure normal horizontal and vertical visibility to see the ground surface and gain visual orientation.

Extended engine operation in conditions of throwing up dust results in compressor and turbine blades wearing out rapidly due to the entry of microscopic solid particles into engine intakes, which in the final analysis either causes engine surging or requires premature engine replacement. In addition, extended hovering at high ambient air temperatures and heavy helicopter loading is not always possible, and is also inadvisable from tactical considerations (a cloud of dust is a giveaway sign).

The above-enumerated adverse factors force a pilot to make the decision to land on and take off from such a site like a fixed-wing aircraft. Lack of experience, however, or an incorrect understanding of certain aspects of flight dynamics cause errors in flying technique which border on violation of safe flying procedures.

Taking Off Fixed-Wing Style

Frequently a pilot, following a ground roll which uses up the entire area suitable for takeoff, after liftoff continues building up airspeed to Vek while remaining at a height of 2-3 meters above the ground. Is this correct procedure?

An important and, incidentally, the sole argument in favor of taking off like a fixed-wing aircraft is the increase in thrust, proportional to increase in airspeed during the ground roll by increasing the velocity of airflow across the main rotor during the ground roll to the abrupt thrust increase when transitioning from axial to oblique flow. Additional increase in speed on ground roll is inadvisable, since this increases the probability of occurrence of induced oscillations of the "ground resonance" and "shimmy" type, making flying technique more complicated during liftoff.

After becoming airborne, a further increase in airspeed at a height of 2-3 meters is inadvisable, since "air cushion" effect disappears entirely at a speed of 60 km/h. This is an axiom of practical aerodynamics. Close to the ground one must devote a great deal of attention to height, resulting in an increased probability of occurrence of deviations in other flight parameters.

Thus the main conditions for taking off in a fixed-wing manner is a site of suitable length, making it possible to obtain the thrust required for the helicopter to become airborne by building up speed on a ground roll. After liftoff, one should continue increasing airspeed, while climbing at Vu, which corresponds to margin of power in relation to main rotor rpm.

In order to reduce the amount of dust thrown up, it is advisable, after the helicopter has begun to move, to reduce pitch sufficiently so as to obtain maximum acceleration on the ground roll. At maximum takeoff weight, if the size of the site permits increasing length of the ground roll, the helicopter should lift off after the main rotor transitions to oblique flow. If liftoff occurs before reaching this point, the helicopter should be held at a height of 2-3 meters, increasing airspeed to 60-70 km/h, subsequently climbing and accelerating to Vek. At normal takeoff weight it is advisable to lift off at an airspeed of 15-20 km/h, first by increasing collective pitch and subsequently with commensurate rearward pressure on the cyclic stick. Liftoff occurs from 3 points.

If during liftoff, when rearward pressure is applied to the cyclic stick, a tendency toward dropoff in forward speed is noted, the pilot should back off pressure on the cyclic stick and lift off with the collective-pitch stick. Pressure should be maintained on the cyclic stick during the ground roll.

One mistake in flying technique merits particular attention when making a fixed-wing type takeoff. It is not considered a particularly serious error and is viewed as a variation of fixed-wing configuration. We are talking about takeoff "off the nose wheel." It consists essentially in the following: the pilot, increasing rotor pitch until reaching full shock strut runout, commences takeoff with maximum forward movement of the cyclic stick in order to achieve maximum acceleration in the shortest roll distance. As airspeed increases due to an increase in overall rotor thrust, due to increased velocity of airflow across the rotor blade (with Gmax), or further increase in collective pitch and throttle (with Gnorm), there occurs an increase in rolling and pitching moment (force -- Tx, arm -- rotor hub-nose wheel). As a result the main-gear wheels lift off and the ground roll continues on the nose wheels. When liftoff speed is attained, the pilot brings the craft airborne with an additional increase in collective pitch.

Since the concept of "takeoff from the nose wheel" first appeared, many helicopter pilots have adopted this technique. Such a takeoff appears to be fairly effective. But the advisability of this method is doubtful from the standpoint of flight safety, first of all because at the initial stage of takeoff "off the nose wheel," the pilot must move the helicopter along the ground at low speed at high rotor-blade pitch. An increase in blade pitch angle with a simultaneous increase in m-cr results in increased velocity of airflow thrown by the main rotor, increase churning of dust, and a sharp deterioration of visibility in the direction of takeoff.

Secondly, the nose gear bears an additional weight load uncompensated by rotor thrust.

Thirdly, part of the rotor thrust, with considerable forward movement of the cyclic stick, is expended on increasing speed in place of increasing required Tu with the same rotor pitch by pulling the cyclic stick back in the process of liftoff. Pilots who have taken off in airplane-style with a helicopter which in a test lift showed only a tendency to become airborne are quite familiar with this.

Fourthly, takeoff "off the nose wheel" presumes helicopter liftoff by collective-pitch stick as the only possible means of increasing thrust (rearward movement of the cyclic stick can cause the main-gear wheels to strike the ground). On a site of limited size the rate of collective-pitch advance increases, and there arises the possibility of overloading the main rotor.

In addition, since the helicopter is resting on the nose-gear wheels, the amount of forward deflection of the cyclic stick is not commensurate with that which is required (cyclic stick deflection does not lead to an apparent change in helicopter attitude). Therefore a "dip" is inevitable after liftoff, that is, additional forward tilt by the helicopter and by the swash plate, which results in decreased Tu and in settling (this deflection as a rule occurs when the pilot removes pressure from the cyclic stick with the trim wheel during ground roll).

To compensate for this deflection, the pilot must increase the rate of increasing collective pitch or pull back on the cyclic stick. Possible consequences are the same.

Evidently one should acknowledge the fact that the very term "takeoff off the nose wheel" is a mistake in flight training methodology. Advocates of such "effective" takeoffs would do well to consider this matter and take a professional look at the technique of fixed-wing style takeoff.

We shall now examine the conditions of flying in a cloud of dust and some psychological features of attention distribution.

In the first place, when visibility worsens in the direction of takeoff during the ground roll, the pilot instinctively shifts his gaze to a piece of ground which is clearly visible. But since the helicopter, as it picks up speed, approaches the edge of the cloud of dust being thrown up, beyond which visibility may be zero, his gaze shifts increasingly toward the bottom edge of the cockpit glass. This considerably diminishes the amount of information on spatial attitude and diminishes monitoring of speed and direction of ground roll. In certain instances pilots of Mi-2 and Mi-8 helicopters attempt to obtain information on speed and attitude by shifting their gaze to the noze glazing. While this is permissible to some degree during a vertical descent, it is a dangerous practice during an airplane-style takeoff.

In the second place, motions in different directions (the ground rolling rearward and clouds of dust moving forward) cause spatial illusions during the ground roll. Since the pilot is looking forward and to the left, he also sees displacement of the dust cloud in the same direction (forward and to the left). And he quite naturally tends to want to bring these opposite-directed motions together by turning his helicopter to the left. Particularly hazardous in these situations are (especially when a pilot encounters this for the first time) soil crusts on alkali flats, bits of the top layer of compacted snow, and tufts of dry grass torn out by the stream of air from the main rotor close to the helicopter. They break loose suddenly and are capable of traveling in different directions due to the turbulence of flow from the fuselage. A pilot involuntarily fixes his gaze on them for a certain time and loses the picture of his spatial attitude.

In these conditions the following typical mistakes are made when taking off airplane-style: an attempt to set the aircraft into motion at a substantially greater pitch than is necessary, in order to reduce time in the dust cloud, which causes more dust to be churned up; an attempt to lift the helicopter off before the edge of the dust cloud, while visibility is sufficient to monitor spatial attitude (it will still be necessary pass through the dust cloud, but while airborne); drifting left during the ground roll.

In order to avoid mistakes it is advisable when taking off to get the helicopter into motion from heavy soil at the minimum possible pitch, with subsequent introduction of correction to the left, lifting off after the engines reach the required rpm. The helicopter should not be brought airborne prior to emergence from the dust cloud, and if visibility becomes seriously worsened, roll axis attitude should be monitored with the artificial horizon and heading with the course indicator. If visibility is maintained to the edge of the dust cloud, just before passing through the boundary one should slightly reduce pitch, emerge from the dust, and then lift off.

Landing Airplane-Style

When landing on mountain-and-desert terrain a helicopter crew first selects a site suitable for landing, determines direction of the landing approach taking wind and approaches into account, chooses a method of landing approach, determines the landing approach maneuver, and sets up for the approach.

We should note that it is no easy matter to select from the air a landing site on mountain-and-desert terrain. The fact is that as a rule the terrain is fairly featureless, lacking terrain reference points for the landing approach. Nor is it a simple matter to select an initial reference point for figuring the approach, or to determine a site's suitability for landing when overflying it, or to determine wind direction.

During passage over a landing site, slopes and terrain irregularities are usually not obvious, and therefore the pilot makes his final decision as he is setting up for the approach at a height of 30-50 meters. Proceeding from wind direction, in all cases it is desirable not to execute a landing approach "into the sun." In a training environment it is advisable to fly over the site at a height of 100 meters and an airspeed of 100 km/h. These parameters are entirely sufficient for a detailed perusal of the ground below and provide time to make or change the landing decision.

As he passes over the landing site, the pilot must determine its elevation on the basis of radar altimeter and pressure altimeter readings (taking into account the elevation of the departure airfield), and determine landing possibilities considering landing weight and outside air temperature.

Wind direction and approximate velocity in the area of the landing site can be determined from aircrew observations during the course of the entire flight (from displacement of dust during movement of vehicles, smoke from munitions bursts, and by direction of flight of birds). It is best to employ a close-in landing pattern, determining by stopwatch the point abeam of the "runway threshold" on the downwind leg and initiation of turn onto base.

In order to keep the landing site in view, the turn onto base should not begin more than 1-1.5 km beyond the point abeam of the "runway threshold" on downwind leg, and height on the turn onto final should not exceed 100 meters. These conditions provide the pilot with normal observation of the site after turning onto final and enable him to set up for the descent on final as he would configure after crossing the middle compass locator.

It is important that the pilot precisely set himself up for the approach descent on final when landing airplane-style: constant airspeed on the approach descent ensures a constant position of the framing of the cockpit glass in relation to the touchdown area. The pilot must maintain a sufficient margin of rotor thrust and ensure capability to initiate a go-around from any point on the glidepath (gliding at low rotor pitch and not cutting airspeed until the main rotor transitions from oblique to axial airflow during the float phase). The pilot should endeavor not to get into dust swirls during the touchdown phase (landing at low pitch or high airspeed).

Experience indicates that it is best to reduce airspeed from a height of 80 meters, so that at a height of 50 meters airspeed is running 70-45 km/h (with wind velocity to 5 m/s, V=45-55 km/h; to 10 m/s -- 50-60 km/h; more than 10 m/s -- 60-70 km/h). The pilot should descend to roundout height at constant airspeed.

For the approach descent the pilot determines an aiming point (TS) and sets up his approach glide to run 30-20 meters short of the touchdown area. This enables him to maintain observation of the touchdown area (to spot slopes or ground irregularities), and at a distance of 300-200 meters and a height of 50-30 meters he can adjust his heading and set down on a flatter spot or make the decision to execute a missed approach and go-around. It is desireable to make the final landing decision at a height of not less than 30 meters.

At a distance of 15-10 meters from the touchdown area and at a height of 3-2 meters, the pilot should pull back on the cyclic stick to level his aircraft and establish the pitch attitude for touchdown (onto the main gear). The pilot should briefly increase Tu, helping to bring his rate of sink to zero.

After touching down, the pilot should reduce to minimum pitch, correct to the left, and apply his brakes. In order to shorten the landing roll the pilot can apply brakes without dumping pitch, applying rearward pressure on the cyclic stick after the nose wheel settles.

Possible mistakes during an airplane-style landing include commencing airspeed dissipation late, as a result of which the helicopter approaches roundout height at a pitch angle whereby rearward movement of the cyclic stick results not in an increase but rather a decrease in Tu and an increase in sink rate; roundout at a height of more than 3 meters. This results in an increase in rate of sink during the float phase as forward speed dissipates, and the pilot must increase collective pitch in order to reduce sink rate to 0.1-0.2 m/s.

The above-described methods have been put to the practical test and have demonstrated a high degree of effectiveness. They can be recommended for training pilot cadets, to trained pilots, as well as when working on one-engine Mi-2 and Mi-8 landing procedures.

3024
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MIR SPACE STATION DESCRIBED IN SOME DETAIL

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[Article, published under the heading "Responding to Readers' Questions," by Candidate of Technical Sciences I. Pochkayev, Pilot-Cosmonaut USSR A. Serebrov, Hero of the Soviet Union, and V. Ulyanov: "Mir Space Station"]

[Text] The new Soviet Mir space station is a natural continuation of its predecessors, the Salyut space stations, and is being used to perform a broad range of tasks in the interests of the peaceful use of space. It comprises a base unit for building a multipurpose, permanently operating complex with specialized orbital modules of scientific and economic function.

The station has six docking assemblies. Five of these are on the transfer module (in the nose section), with a sixth docking assembly on the service module. First modules approach the forward axial assembly, dock, and then are moved with the aid of a robot arm to one of the radial stations. In addition, the multipurpose orbital complex includes Soyuz T and Soyuz TM manned spacecraft, as well as Progress-class cargo craft.

In the future, when orbital modules, each of which has its own function, are added to the complex, scientific and technical capabilities will substantially increase. The space station proper will perform the function of a central command and control facility for all systems in the complex.

Dimensional specifications of the Mir space station are in large measure similar to those of the Salyut: overall length -- 14 m, maximum diameter -- 4 m, mass -- about 20 tons, unencumbered interior space -- 100 cubic meters. The station was lifted into orbit by a Proton booster. After being placed in orbit, the solar panels and antennas were deployed by radio command from Mission Control, and the station shifted into automatic flight mode. Subsequently the first manning crew arrived -- L. Kizim and V. Solovyev. Operation of the complex in manned mode began from this moment.

The space station consists of a transfer module, work module, and service module, and a service module transfer tunnel, all interconnected by airtight hatches.

The spherical transfer module, 2 meters in diameter, contains five passive docking assemblies. The central module assemblage runs along the station's longitudinal axis, while lateral components are positioned 90 degrees to the central module assemblage. Docking transfer gear, approach system antennas, approach and docking monitoring TV cameras, running lights, and devices for monitoring mutual alignment during manual docking procedures are mounted on the transfer module exterior, which is covered with thermal insulation.

The interior of the transfer module contains temperature control equipment, equipment for providing station atmosphere proper gas composition, equipment for performing onboard measurements, radio communications, video and lighting equipment.

The work module, consisting of two cylinders of different diameter, joined by a cone, constitutes the working area of the base unit. The floor, walls, and ceiling are painted different colors in order to facilitate spatial orientation within the module. The solar panels and sensors, electronic communications system antennas, handrails for EVA activities, and viewing ports are on the exterior surface of this module.

The smaller-diameter bay or work area, as it is called, is the crew's principal working area. From here cosmonauts run the complex and monitor its systems. Instruments and consoles for monitoring and control of station systems, optical sighting devices for station orientation and alignment, star-tracking and astronavigation instruments, radar and television equipment, communications equipment, control consoles and lighting equipment, and two cosmonaut seats are located in the lower part of the bay.

The larger bay (living area) is equipped with the aim of providing the most comfortable possible conditions for the crew. Two "bunkrooms" are located along the starboard and port sides. They provide relatively "terrestrial" conditions for sleep and rest, and contain viewing ports for external observation. There is a folding seat on which a cosmonaut can read or take notes. Sleeping bags are placed vertically along the side wall of the "bunkroom." There is a mirror on the opposite wall. A "bunkroom" contains lighting, ventilation, personal hygiene facilities, and a toiletry and personal needs kit.

The space-station wardroom is located on the starboard side. Folding covers serve as panels to hold food items in place, with waste packet valves alongside. An electric heater with control baffles for heating meals is mounted into the wardroom table. There is a refrigerator across from the wardroom table, on the port side. Four persons can be meal-accommodated simultaneously in the wardroom.

A combined physical-training unit is located next to the wardroom. Behind a protective screen there is a head, washroom, waste receivers and containers, water containers, fans, and a cabinet for personal hygiene items. Under the floor of the living area there is an airlock for removal of waste.

The service module transfer tunnel is at the rear of the base unit, with a passive docking assembly. Cosmonauts pass through it from a docked spacecraft to the base unit. The transfer tunnel contains equipment of the docking system, water supply system, electronics and other systems supporting station operation, as well as personal hygiene items.

The service module does not have an externally separate appearance. Together with the work module it forms a single station exterior surface 4 meters in diameter. It is identifiable, however. The words "Mir" and "SSSR" are prominently stenciled on its exterior surface.

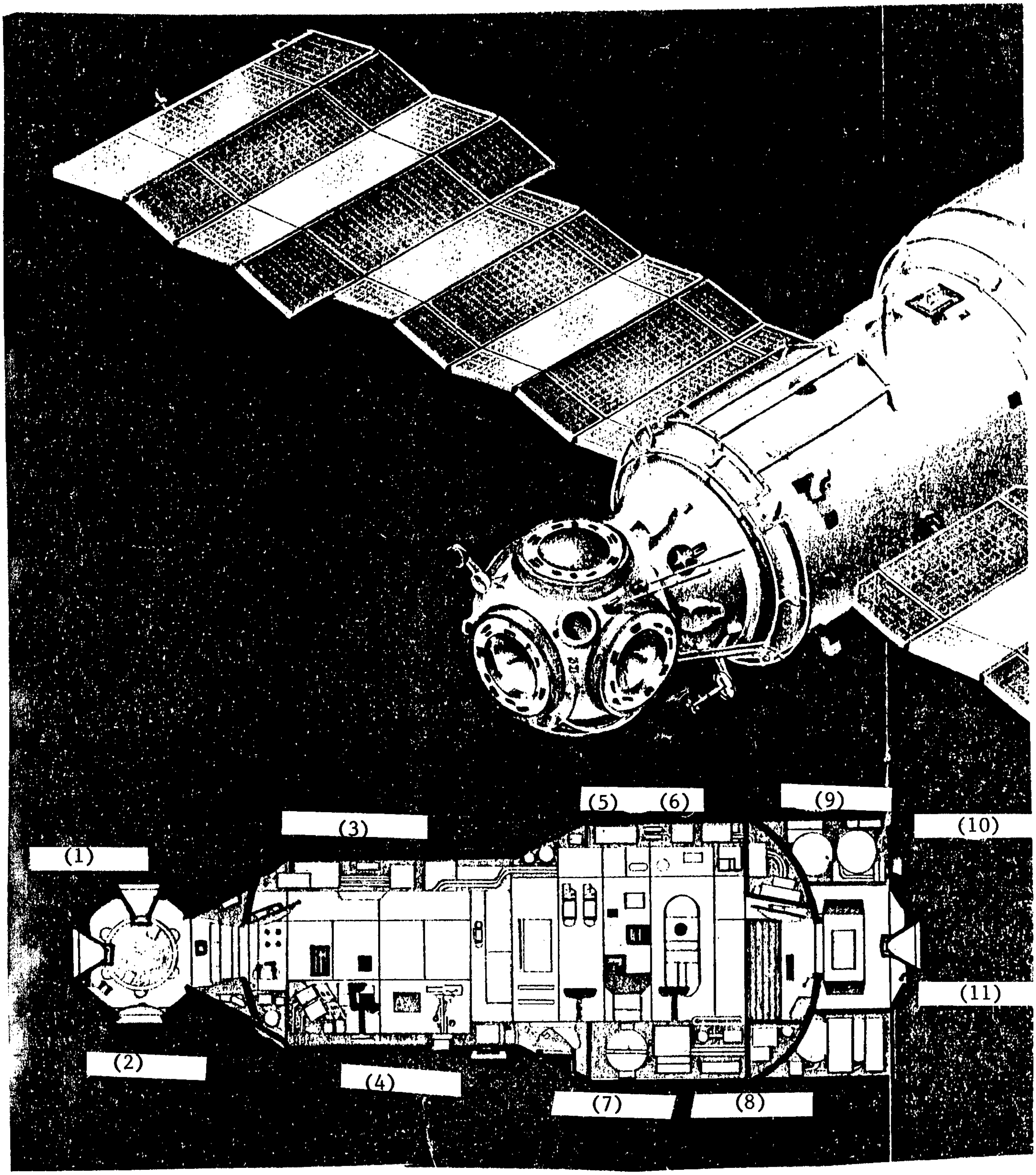
The service module contains fuel and oxidizer tanks, fine-adjustment thrusters, base-unit yaw, roll and pitch control thrusters, temperature control system and docking system equipment. A highly-directional antenna is mounted on the module exterior. It is aimed at a communications relay satellite, which provides communications between the station crew and earth when the Mir is beyond line-of-sight of land and shipborne tracking stations. Running lights and solar sensors are positioned around the exterior of the service module.

Station equipment includes computers, which form a powerful data-computing system which makes it possible maximally to automate the control process and accomplish the mission program. Monitoring and analysis of the operating condition of the onboard digital computers, display of instructional and reference information, as well as computer-operator interactive-mode operations are accomplished with display-keyboard terminals. Other equipment includes command and emergency warning signal panels, panels for monitoring and issuing commands, propulsion control, monitoring and control of electric power and lighting systems, jettisoning of waste, water regeneration, cosmonaut EVA support, etc.

Maintaining the station in a predetermined attitude in unmanned mode and performance of manual attitude control and stabilization of the base module is accomplished by an attitude control system, consisting of optical sensors, visual orientation devices, control panels and levers, gyroscopic instruments, and an aggregate of logic switching and converter units. In manual attitude control, the crew employs optical sighting devices and star-tracking devices, which make it possible to position the space station axes with a high degree of accuracy on the basis of the local vertical, the Earth's horizon -- the Earth's surface passing below -- or the stars. The control panel and levers generate the appropriate control commands to the station propulsion unit.

Figure on following two pages:

Key: 1. Docking assembly; 2. Transfer module; 3. Central control station; 4. Work area; 5. Table; 6. "Bunkroom"; 7. Waste removal; 8. Living area; 9. Service module; 10. Docking module; 11. Service module transfer tunnel



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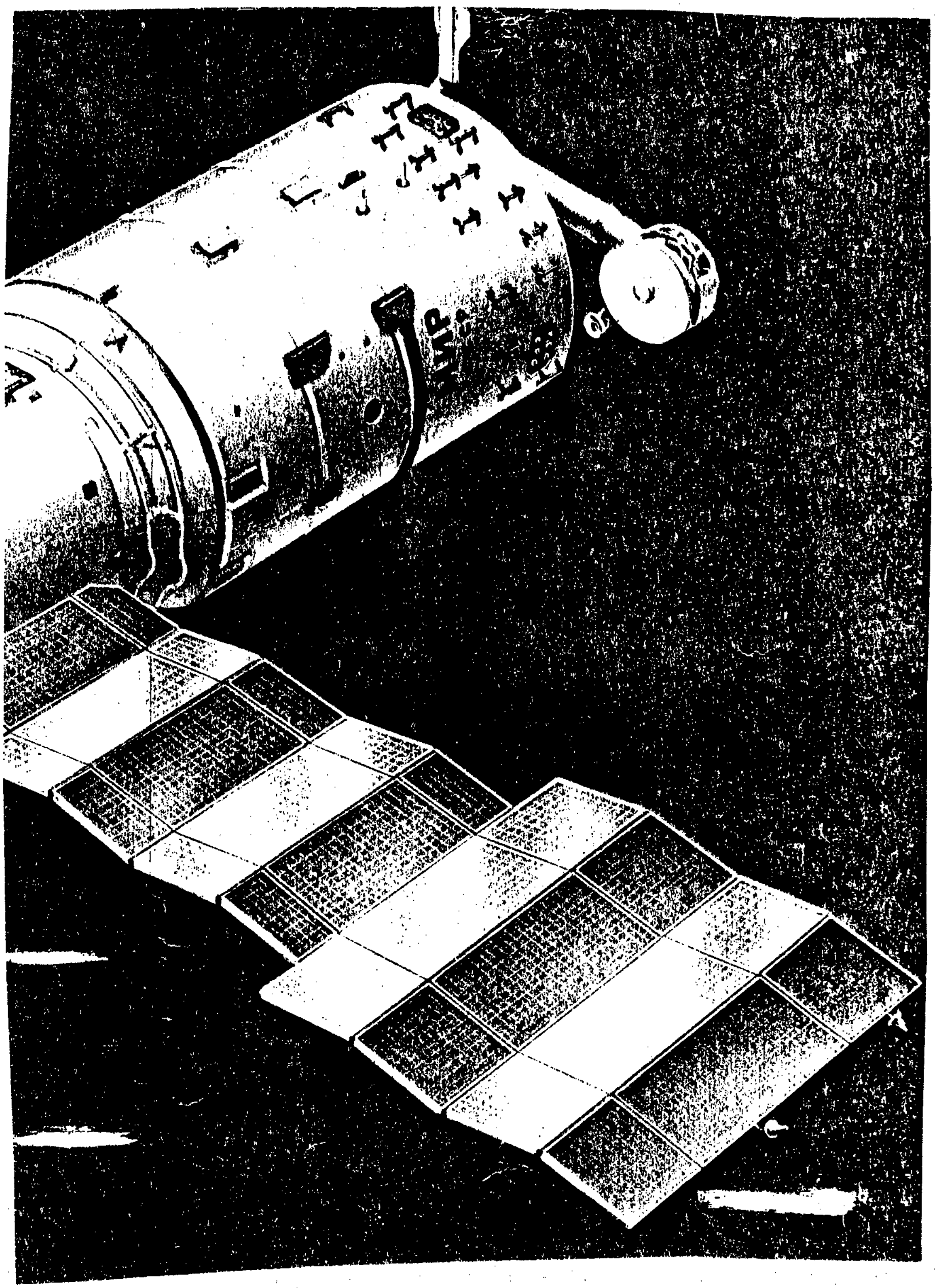

The station's propulsion system includes a system of low-power thrusters and two high-thrust motors. The former generate moments which control station motion relative to its center of mass and forces which produce small changes in its motion. They are located on the exterior surface of the base unit. The high-thrust motors are positioned at the rear of the service module and are intended for producing substantial changes in the station's orbital parameters. Propellant is fed to them by compressed gas in cylinders. There are provisions for refueling from cargo spacecraft via special fueling connectors on the docking assemblies. Cosmonauts control and monitor operation of the attitude thrusters and propulsion motors from panels located in the living area of the work module.

The electric power supply system provides power to the base unit's instrumentation and systems, docked transport craft and orbital modules, and can charge their storage batteries. The system includes solar panels and storage batteries, automatic control gear and telemetry monitoring devices. the surface area of the solar panels has been increased to 76 square meters from the 51 square meters of the Salyut 7. Their efficiency has also been boosted by installing gallium arsenide solar cells. The panels are oriented to a position perpendicular to incidence of the sun's rays with special drive mechanisms controlled by signals generated by sun position sensors. The station has several storage batteries connected in parallel to the primary source of electric power -- the solar panels.

On each orbital revolution the station is in the Earth's shadow approximately 40 percent of the time. The pattern of electric power consumption alternates between small loads when the crew is sleeping or resting and comparatively large loads when control, TV, scientific equipment and communications systems are switched on. A buffer storage battery performs the function of an easily-switchable source of power during peak demand. It provides favorable smoothing conditions for equipment operation. A backup storage battery can be switched on if it become necessary to increase power output.

Automatic electric power control devices protect the storage batteries against extended discharge or overcharging, monitor power supply system parameters, and establish ground or spaceborne control mode.

After a transport craft docks with the Mir station, both power systems are linked together. The spacecraft's buffer storage battery is placed on standby fully charged, while its solar panel is hooked up in parallel with the base unit's solar panel array, forming a common electric power supply system.

The station contains lighting devices of four basic categories: general, on-duty, local lighting, and controlled-brightness lighting. Lights are switched on from a central lighting panel and from local panels located in the various modules and bays. Power receptacles are available in all modules and bays for powering portable equipment.

The temperature control system is an aggregate of devices which maintain within a predetermined range the ambient temperature of onboard equipment, structural components, as well as station interior temperature and humidity.

It also provides ventilation within the station, transport craft and orbital modules.

The system contains sensors which monitor equipment and air temperature, automatic and manual control system units, actuating control elements, and heat-exchange devices, which radiate into space excessive heat generated by operating equipment.

Most of the system components are mounted on station exterior panels. Heat and moisture exchange between base-unit modules and bays, transport craft and orbital modules is accomplished with the aid of easily-removable air ducting.

The temperature control system consists of exterior and interior cooling and heating loops and an intermediate loop. It provides an air temperature within a range of 18-28 degrees C. The preselected station temperature conditions are maintained automatically, but the crew can also manually switch on heaters, air conditioners, and fans as appropriate. The crew checks temperature and humidity daily in all modules, bays, and sleeping quarters. Gas analyzers monitor the composition of the air on board the base unit.

Cosmonauts consume "canned" water delivered by Progress cargo craft. The water is prepared on the ground, adding silver ions, and poured into 10-liter containers. It has a shelf life of up to a full year. The base unit also contains a system to recover water from the atmosphere, similar to the unit on board Salyut 7. The daily standard per-cosmonaut water consumption figure is almost the same as on Earth -- approximately 2 liters.

Cosmonauts eat four meals daily. There are several daily meal-package variations, containing various food items. Meals usually include squeeze tubes, canned items, vacuum-dried meals, bread, fruits, vegetables, tea, and coffee. Cold or hot water from the water regeneration system is added to dehydrated food items before consumption, and vacuum-dried items are reconstituted.

The station contains a refrigerator for storing food. Its thermostat maintains a cooling range from -3 degrees to -10 degrees Celsius, and it has a capacity of 40 kg of food supplies. The refrigerator must be defrosted, just as on the Earth. It is designed to provide ease of repair and replacement of principal components.

The washroom cubicle provides conditions close to terrestrial. It consists of a spherical shell with slits in the sides for the arms and in its upper part for the face. Water consumption is far below terrestrial -- only 0.3 liter per person. Special soap packets are used. When washing procedures are completed, the cubicle is thoroughly wiped with special hand towels.

The head, in the form of a special cubicle, is equipped almost the same as on Earth. It differs only in special suction removal and ventilation systems. The hygienic support package includes sets of underwear, workout undergarments, sleeping bags, and personal hygiene items. Station cleanup is periodically performed with vacuum cleaner and moist hand towels.

An exercise bicycle and treadmill are provided for physical exercise. In addition, a set of spring-resistance expander devices, Pingvin and Chibis suits are available.

During a communications session L. Kizim reported: "The space station is nice, well lit, spacious, and clean."

This assessment by a cosmonaut who has had experience on board three orbital space stations attests to its truly high quality.

The measured process of awakening the space station by the newly-arrived crew was soon completed. On 19 March an unmanned cargo freighter was boosted into orbit, after which a Mir - Soyuz T-15 - Progress 25 linked-up complex was formed. The cargo spacecraft delivered additional equipment for the base unit, fuel, tools, food supplies and, of course, long-awaited mail.

We should note that unloading cargo in space is no easy matter. The cosmonauts, following a rigidly specified sequence, the reverse of that performed on Earth, had to remove the equipment cargo from its securing points. Down on the Earth, however, it had been installed in place by sturdy lads who had tightly cinched up the nuts and bolts. It is for this reason that L. Kizim and V. Solovyev repeatedly asked the Mission Control communications operators: "Can you send up some tools? We need more wrenches."

After unloading Progress 25 and refueling the station, the crew proceeded with testing the various onboard systems, in the process of which, according to the cosmonaut reports and telemetry data, it was determined that the manned complex was functioning normally.

In accordance with the mission schedule, the crew tested a new electronic communications system which enables them to communicate with Mission Control via a communications relay satellite when the manned complex is out of line-of-sight with the Soviet Union. A Luch satellite (Kosmos 1700) was used as a relay. During testing, in addition to two-way mission-related communications, a TV reporting session was held. Radio and TV signals, traveling tens of thousands of kilometers, brought cosmonaut video and voice transmissions to Mission Control.

On 16 July 1986, at 1636 hours Moscow time, the crew of the Mayaki returned to Earth, completing the first phase of research and testing of the Mir orbital scientific space station.

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PROBLEMS SPECIFIC TO ROTARY-WING AIRCREWS DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 28-29

[Article, published under the heading "Constant Attention to Flight Safety," by Mag Gen Med Serv V. Kopanev and Col Med Serv V. Yegorov: "Specific Features"]

[Text] Constant concern on the part of the Communist Party and Soviet Government with strengthening the Armed Forces, as well as advances in Soviet science, technology, and the Soviet economy are creating the necessary conditions for a continuous improvement in equipping the Air Forces, including in the area of helicopter engineering. Today rotary-wing aircraft of various types are extensively utilized in all arms of the military to accomplish the most diversified combat training tasks.

As practical experience indicates, the activities of helicopter crews possess quite specific features. In particular, the structure of helicopter control movements differs considerably from the actions of a fixed-wing pilot. This is determined first and foremost by the performance characteristics of the aircraft in question. While a fixed-wing aircraft is more stable on the transverse axis (pitch axis) than the longitudinal axis (roll axis), a rotary-wing aircraft on the contrary has its greatest instability on the pitch axis. For this reason when flying a fixed-wing aircraft the number of roll-control motions performed by the pilot exceeds the number of pitch control motions. A different relationship is observed in flying a helicopter: the number of longitudinal motions averages 45-65, transverse motions 5-15, and mixed (diagonal) -- 20-40 percent. The total number of control movements varies between different phases of flight. During takeoff, for example, up to 48 control motions on the average are performed in a span of 30 seconds, as many as 35 in level flight, up to 55 during the landing approach descent, and as many as 72 motions during landing.

Flying a rotary-wing aircraft requires not only a large number of movements but also extreme precision of motions, good coördination in amplitude, promptness of actions, and a specific sequence of actions.

Spatial orientation in a helicopter is somewhat more difficult. As studies have shown, this is due to the fact that a helicopter changes position very rapidly in relation to any of its axes. The pilot's functional system which provides spatial orientation operates under difficult conditions. It is overloaded with information from the visual, vestibular, and other analysors, which increases the probability of spatial disorientation.

When flying a helicopter close to the ground, just as when flying a fixed-wing aircraft, a pilot perceives motion from the apparent displacement of ground objects. During a vertical climb or descent, he observes displacement of the ground surface as radial motion directed from or toward the center of the takeoff point. When flying above a featureless water surface or snow-covered plain, it is difficult visually to estimate height (especially when initiating hover prior to landing). In addition, if there is a ripple or chop on the water surface, the illusion of movement may occur during hover. The following fact is also of interest: the so-called stroboscopic effect ("strobos" -- whirling) from the turning rotor can occur during flight. It consists essentially in the eye's ability to retain light effect for several tenths of a second (inertia of vision). When the rotor is turning at a speed corresponding to inertia of vision, the pilot perceives the same phase of blade position. If closely-adjacent phases are perceived, the rotor appears to be moving slowly. A young or insufficiently experienced pilot may perceive this phenomenon as engine failure, which in turn will result in incorrect pilot actions and the development of an in-flight emergency situation.

A poorly-trained pilot experiences considerable emotional stress when flying a helicopter, as a consequence of which his working efficiency declines and he rapidly becomes tired. Studies have shown that the manifestations of such stress vary and are more marked in emotionally-vulnerable individuals.

The formation of emotional-volitional stability presupposes the creation of conditions for airmen to be in a good mental attitude, calling and maintaining emotional states which positively affect pilots' behavior and actions, as well as thorough preparation for a flight, and development in crew members of composure and confidence in their own ability and in the reliability of the equipment. This is achieved by all forms of party-political work and job-specific training.

One way to achieve emotional toughness in airmen is to use flight simulator facilities taking into account crew members' specific flying and combat duties, in order to develop in them reaction speed and precision, specific properties of attention, the most economical thought process, to increase memory capacity, etc. Special physical exercises which promote relaxation, for example, have proven effective. Self-monitoring of emotions and autogenous drills are mandatory.

Of the factors which adversely affect helicopter crew members in flight, we must consider first and foremost noise and vibration which, due to the specific features of design and construction of rotary-wing aircraft, are more substantial than in a fixed-wing aircraft. The noise level in helicopter cockpits can run as high as 112 db, and can run as high as 120-125 db where technician personnel are positioned. As we know, the central nervous system and the auditory organs are most sensitive to noise. In order more easily to tolerate noise in flight and to diminish its adverse effect on the organism, airmen must adhere strictly to a proper regimen of sleep, rest and diet and wear hearing protectors during flight. A headset, for example, reduces noise at various frequencies by 22-45 db.

Vibration in helicopters, particularly low-frequency vibration, primarily affects the locomotor system, the nervous system, and makes it difficult to read instruments. Preventive measures which diminish the effect of this adverse phenomenon on the airman's organism for the most part prescribe physical-therapy procedures. It is recommended that aircrew members take a warm bath or shower (36-37 degrees C) after flying and before bed, with subsequent massage of extremities, plus a mandatory set of physical exercises and vitamins.

As a rule helicopters fly at low altitude and are subjected to air turbulence. This results in substantial deviations from specified flight parameters on the various axes, as well as abrupt accelerations of brief duration which swing back and forth (alternating G loads). They can cause motion sickness or, more frequently, a latent form of motion sickness. This dictates the necessity of regular vestibular conditioning for flight personnel of rotary-wing units.

A strong sense of responsibility on the part of helicopter crew members for successful accomplishment of flight assignments, a continuous psychological preparedness to meet any test whatsoever, and rigorous observance of a proper regimen of flying, sleep, rest, and diet, as well as precise observance of doctor's recommendations -- these guarantee high-quality and mishap-free flight operations.

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BOMBERS ATTACK AMPHIBIOUS TASK FORCE IN EXERCISE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) p 29

[Article, published under the heading "Implementing the Decisions of the 27th CPSU Congress," by Military Pilot 1st Class Lt Col V. Ponomarev: "Practice Targets Under the Wing"]

[Text] Reconnaissance conducted during the tactical air exercise confirmed that the "enemy" was preparing to mount an amphibious landing. A force of amphibious warfare ships and escorts had put to sea.

The command authorities decided to destroy this force en route to the objective area. This mission was assigned to a bomber squadron under the command of Military Pilot 1st Class Maj V. Dolgov. It was a difficult mission even for experts at combat flying. The considerable distance from navaids made it even more difficult to fly out and search for targets above a featureless expanse of sea. And just the fact of flying a mission at extreme range required thorough, comprehensive preparation.

That is why the squadron's pilots prepared very thoroughly for this tactical air exercise. They devoted particular attention to improving procedures with control, performance, and navigation instruments, their ability to work with backup electronics, with active "hostile" jamming efforts, as well as study of the tactics of the potential adversary and the specific features of organization and capabilities of his air defense assets. All this made it possible to choose the most effective attack maneuver.

...The cockpit clock commenced time count with liftoff. The bombers took off one after the other. Joining up after becoming airborne, the bomber strike force turned to the enroute heading. Taking off behind them were the decoy aircrews. The squadron commander's plan assigned an important role to the latter: diverting attention to themselves, they were to enter the enemy's air defense zone, while in the meantime the strike force, proceeding at low level, would suddenly and unexpectedly approach the target area, with thunderclouds behind them. It was a risky but entirely warranted decision, for the aircrews would obtain a considerable advantage, with their presence obscured on hostile radars among the clutter caused by interference and electrical discharges.

This would enable them to deliver a lightning-swift bombing strike and depart the area at low level, evading hostile air defense fire.

The leader of the strike force, Maj V. Dolgov, glanced at his watch. It was time! The decoy element moved out ahead, climbing to a higher altitude. The strike force leader's bomber proceeded to descend. The strike force pilots executed a maneuver which had been thoroughly rehearsed on the ground in a "walking it through" drill session. Although not one instruction came over the radio (the bombers were maintaining radio silence), the wingmen precisely followed all maneuvers by the element leader. Such precision formation flying ability is a result of long, truly persisting effort.

"Target ahead! Prepare to attack!" Major Dolgov soon radioed the others.

Approaching the target at high speed, the bombers delivered their ordnance and, descending further, proceeded to exit the zone of hostile antiaircraft fire.

The tactical air exercise was an important test for these airmen. They received high marks on their performance.

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FIRST MANNED MISSION TO MIR SPACE STATION DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 36-37

[Article, published under the heading "The Space Program Serving Science and the Economy," by Col V. Gorkov, candidate of technical sciences: "Circular Route: Experiment and People"]

[Text] At a press conference on the manned mission flown by L. Kizim and V. Solovyev, the director of projects for the development of manned spacecraft for international crews, Hero of Socialist Labor Yu. Semenov, noted: "Unquestionably the brightest page of this crew's mission would seem to be the cosmonauts' flight on the Soyuz T-15 on the route Mir - Salyut 7 - Mir. We consider this element essential for future servicing of extensive orbital complexes, preventive maintenance, repair, fueling, and ferrying equipment to platforms positioned in various orbits, which would be supplied by manned and unmanned cargo craft based at orbital stations."

I immediately recalled events which took place 20 years ago. In the mid-1960's Leningrad scientist Professor K. Barinov, suggested, in one of his writings, a name for such flights -- koltsevoy marshrut [lit. "circular route" -- orbital out-and-back mission]. Erudition and knowledge of mathematics and the history of technology enabled Konstantin Nikitovich Barinov to introduce this term. During those years he suggested that I make a study of matters pertaining to ballistic calculation of circular routes. I should state that at that time we were not yet docking spacecraft; it was a thing of the future. That did not faze this scientist one bit, however -- he was looking beyond. In a conversation with me Barinov drew, one after the other, captivating pictures of space flight, each time adding: "Believe me, young man, this will happen very soon; it is necessary only to do the proper groundwork."

I enthusiastically set about to work on the topic he had suggested, and within a few years we were able to provide accuracy, energy, and time estimates of orbital out-and-back missions. Some of the results of these studies were published in an article entitled "Interorbit Flights With Return" in the journal AVIATSIYA I KOSMONAVTIKA 10 years ago, as well as in a book published by Mashinostroyeniye in 1982 entitled "Mezhorbitalnyye i lokalnyye manevry kosmicheskikh apparatov" [Spacecraft Interorbit and Local Maneuvers].

And now cosmonauts L. Kizim and V. Solovyev, having brilliantly demonstrated the capabilities of Soviet space hardware, were the first actually to fly an orbital out-and-back mission. This experiment will take its deserved place in the history of space exploration.

We frequently speak the word "first," investing it with natural respect for trailblazing decisions. And most frequently we associate it with the past, on each occasion recalling the participants in a given event. Yes, it is essential to study the experience of the pioneers of the space age. But it is no less important to disseminate the experience and know-how of the vanguard of today's labor and military events.

Take, for example, those who took part in preparing for and conducting the most recent space flight. In preparing this article, I recalled a conversation with Maj Gen Avn Yu. Bondarenko, chief of the Political Department of the Main Staff of the Air Forces.

"You must stress," he stated, "that initiative is today required of everybody more than at any time in the past. Initiators are those pioneers who make history."

Thus Yuriy Petrovich concisely and accurately formulated a demand of the times. Indeed, intelligent initiative can speed up decision execution time, such as on this mission, for example. Innovative thinking on the part of each participant, be he in space or on the ground, enriched the overall plan and concept. And its sources remain the same as they were 10, 20 or more years ago. They include a strong inner need to carry out one's duty, pride in one's labor, involvement in our homeland's great accomplishments, and total devotion to the job at hand and to conceptual plans.

Leonid Kizim and Vladimir Solovyev possessed precisely these qualities. This was brought home to me strongly when I talked with Maj Gen Avn A. Filipchenko and the crew's instructors. All of them gave the same reply to my question: "What determines the character of a cosmonaut?": "A strong motivation to work for the good of society."

...Leonid Kizim and Vladimir Solovyev came to the Cosmonaut Training Center imeni Yu. A. Gagarin by different paths. They had received a different family upbringing and education. But a common understanding of the meaning of life and a unity of goal helped them rapidly draw close and understand one another.

Their careers came together in September 1981, when these cosmonauts were named to the crew backing up the Soviet-French crew. Leonid and Vladimir have been working together since that time. They have achieved an ideal compatibility. Only persons of high ideals, united by a common goal, are capable of this.

Kizim and Solovyev head the list of total time in space, occupying the first two lines: the mission commander -- 375 days, and the flight engineer -- 362 days, with a combined total of 32 hours in EVA. They are presently the most experienced space hardware repair team.

We are all familiar with the expression: "An individual is a matter of style." It applies particularly well to Leonid Kizim. A man of few words, cautious, a person who does not draw hasty conclusions, he nevertheless reaches the required results no later than others. If the saying "Haste makes waste" had not existed for centuries, one could believe that it had been coined from watching this mission commander work.

Instructors V. Afonin, A. Belozerov, and V. Zorin, flight surgeons I. Tarasov, V. Zavanyuk, R. Bogdashevskiy, and A. Kulev, as well as other specialist personnel helped him prepare for this mission. It became clear in the course of the mission how seriously and innovatively Leonid Denisovich had approached the training and preparation process. During practice sessions he was never in a hurry to bring lateral velocity to zero until he was absolutely sure of the parameters required to solve the station docking approach problem. He was repeatedly reproached for this, but Kizim insisted on doing it his way. His life experience had taught him that every docking is different. And he, as any innovative person, was seeking new solutions.

When they were training for the mission, there was not a single simulator providing a linked-up Salyut 7 - Kosmos 1686, and the cosmonauts saw it for the first time when they were actually on the mission. It would seem to be unimportant whether two objects are hanging suspended in orbit or whether a single object, a large or small one. You still execute a docking approach to a single point. But imagine that you are sitting in a Zhiguli passenger car toward which a BelAZ truck is slowly approaching. This would cause anybody to be nervous. But when the Salyut 7 - Kosmos 1686 unit began looming ever larger in the viewing port, Kizim did not waver a bit. This is indicated by the telemetry data. At the sight of this monster he first slowed covergence to zero and then calmly proceeded with his docking approach.

Today the methods specialists use his work style as an example, as I have heard time and again. And this also constitutes invaluable experience in our inventory of knowledge about space flight.

Vladimir Solovyev is more adaptive and easier to communicate with. And a great deal achieved by the crew on this mission depended on him. As navigator, he guided the spacecraft with sureness along its orbital out-and-back trip. At difficult moments the instructors got to Kizim through him, the flight engineer. Vladimir Alekseyevich stated at a rally at Zvezdnyy Gorodok just how difficult their mission had been: "It would seem that the dreamers had foreseen everything on extended space flights. Everything but one item: they had failed to consider all the difficulties connected with accomplishing the flight."

The instructors, engineers, and doctors -- everybody who prepared for and provided support for this mission -- are rightfully entitled to share the cosmonauts' success. As we know, it is much more difficult to formulate a task than to execute it. This can be accomplished only by those who are capable of thinking with depth and breadth, of synthesizing facts, of pondering these facts, of seeing the whole picture and the end results of the conceptual plan long before it is carried out. Precisely this was required of V. Afonin, A. Belozerov, A. Yezhov, V. Zorin, V. Petrov, I. Sokhin, V.

Gotvald, A. Kulev, and others when they were preparing methods, teaching and escorting the crew in orbit while themselves remaining on Earth. And although each of them worked in his own small, assigned area of responsibility, they all became excellent reviewers of the design concepts which are opening up broad prospects for the further conquering of space.

No less important are the activities of those who develop the space hardware, the test personnel at Baykonur and the space command, control and telemetry complex, the people at mission control and the establishments taking part in mission support. If there had been missing any one of these, concentrating his efforts in his assigned area of responsibility, the main thing, which we are discussing today, would not have come to pass. It was they who designed, built, tested, prepared and launched into orbit the first elaborate space system, which includes the Mir and Salyut 7 stations, the Soyuz T-15 manned spacecraft, the unmanned Soyuz TM, the Progress 25, Progress 26, and Kosmos 1686 cargo craft, and it was they who guided this system in flight. This was the largest volume of work performed in such a short time ever experienced by the space program which, thanks to these specialist personnel, has climbed another notch in its development.

Everything the first manned spacecraft carried a quarter of a century ago was to be found on the Soyuz T-15 spacecraft. At the same time the difference between them is no less than the difference between a prewar aircraft and today's modern airliner. The new Soyuz TM spacecraft will open up even wider the possibilities of manned space exploration. It employs a sophisticated approach and docking system. This system underwent its first tests in May, during which it drew abreast in automatic mode and subsequently docked to the predetermined station docking assembly without first aligning and holding alignment of the station to the approaching craft. This is very important if one considers that the mass of future orbital systems will be steadily increasing. Since we are discussing the prospects opening up in connection with accomplishment of the first orbital out-and-back mission, we should note one additional thing. As we know, before a new spacecraft can take its place in the space program, it must go through a process of "breaking in," in the course of which all new design and construction elements are tested out. Kosmos 1686, just as its predecessor, Kosmos 1443, is no exception to this rule. It is to become not only a more powerful cargo craft and orbital transfer vehicle, but also a prototype of future orbital modules.

Investigations of the Earth's atmosphere and cosmic particles, for example, were conducted with special equipment on Kosmos 1686. In particular, ejections of gases, ash, and other matter from active volcanoes were observed. The dynamics of movement of this matter in the atmosphere were recorded and their composition examined for the first time. In conducting such diversified investigations, the new spacecraft confirmed that it can be incorporated as an active module in an orbital working and living complex.

Thus the Soviet space program is now very close to the development of specialized modules, each of which will become a scientific laboratory or industrial installation. These could include an observatory above the Earth's atmosphere, a biological greenhouse, or a melting-furnace installation producing unique metal alloys or semiconductor crystals.

Nevertheless creation of the Mir third-generation space station was the most important achievement. It differs from its predecessors primarily in the fact that for the present day it meets all requirements imposed on permanent orbital laboratories. The reader can become acquainted in greater detail with the new space station by reading the article featured in this issue of the journal.

As we have noted, all technical innovations must be tested and checked out. This is why the cosmonauts' work on this mission began on board the Mir space station. They had been briefed in advance on its design, construction, layout, and some of its systems. Upon arrival at the station, the cosmonauts performed installation and takedown tasks and checked all station systems, its computer system and electronics -- in short, brought it to life.

This crew is distinguished by a high degree of organization and know-how. It can perform with precision "extemporaneously," so to speak. For example, the cosmonauts had not been given a detailed briefing on the ground on the Strela information system. When it was necessary to run it through test procedures in space, all they needed was two briefing sessions with specialist personnel. In all other activities they worked on the basis of onboard documentation. Working on board the Mir space station, L. Kizim and V. Solovyev made a contribution toward finishing touches on and final adjustment of new equipment, applying the necessary "touches" which are always needed in the final stages, and they made the station fully ready for the next crew.

The cosmonauts performed two EVAs while on board the Salyut 7. This time they thoroughly checked out in various operational modes the unit for assembling large structural elements. In the process of the Mayak [Beacon] experiment they performed tests on deployment and takedown of a hinged truss assembly of varying length, its dynamic and static characteristics. They tested welding and brazing operations on rigid connections using multipurpose hand tools, removed and subsequently returned to Earth cosmic dust recording units set out in 1985, as well as numerous specimens of various materials which had been exposed to the space environment. This will help experts assess their potential service life.

Returning from the Salyut 7 to the Mir space station, the cosmonauts transferred via the Soyuz T-15 film camera, still camera, and spectrometer gear, a spacesuit and other equipment, demonstrating the capability to equip one system at the expense of another. The economic aspect also plays an important role here: costly equipment will continue to be used for its intended function. In addition, scientists will be able to assess its potential service life.

Each space flight requires thorough preparations, profound knowledge, a great deal of courage and hard work. This most recent mission differed from previous ones also in the fact taht it was being closely watched by the world community. It constituted the first step taken by the Soviet manned space program toward implementing the historic decisions of the 27th CPSU Congress, which defined our country's course of strategy at a turning point in our development. This was borne in mind by all those who took part in preparing for and conducting the flight. And each of them felt a deep sense of inner satisfaction at the results of their labor, so brilliantly culminated by Leonid Kizim and Vladimir Solovyev.

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MARS-MISSION PHOBOS PROJECT DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 38-39

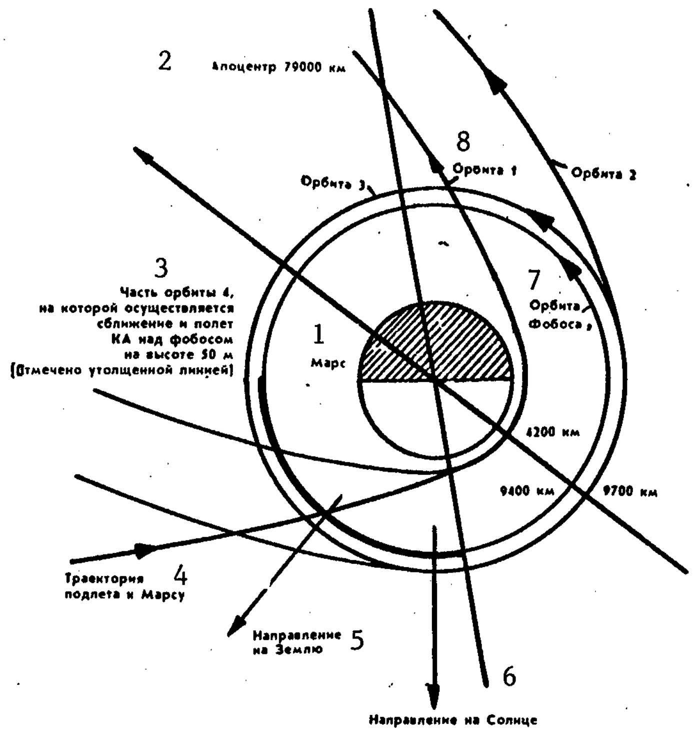
[Article, published under the heading "Responding to Readers' Questions," by V. Balebanov, deputy director, USSR Academy of Sciences Institute for Space Research: "Project 'Phobos'"; third article of a four-part series, see Nos 9, 10, 1986]

[Text] In July 1988 two spacecraft will be launched, with an interval of several days, from the Baykonur space launch facility. Initially they will go into Earth orbit, and subsequently will head toward Mars. The flight will take 200 days. The distance between Earth and Mars will be 180 million kilometers at the moment they arrive. Upon approaching the planet, the space vehicles will move into a highly-elongated elliptical orbit positioned above the Martian equator (orbit 1). Subsequently the orbit perigee will be increased to 9,700 km (orbit 2).

The space vehicles will remain for about 60 days in intermediate elliptical orbits. After this they will move into a circular orbit with a period of revolution of 8 hours (orbit 3), in which they will spend from 35 to 140 days. From this orbit the vehicles will commence the "hunt" for Phobos, gradually shifting into a circular synchronous orbit with a 9,400 kilometer pericenter. Phobos -- one of the main objectives of this mission -- circles Mars in precisely this orbit. Hence the name of the project -- Phobos.

The mission program calls for taking TV images of the Martian surface with a high resolution of radiometric and photometric measurements in order to obtain a Martian surface temperature map, study of diurnal and seasonal temperature dynamics, measurement of the thermal inertia of the Martian soil, a search for areas of permafrost as well as for areas releasing internally-produced heat. It is also planned to obtain data on the mineralogical composition of the Martian surface.

Recording of Martian gamma radiation by the Mars 5 unmanned interplanetary probe in 1974 made it possible to determine for the first time the nature of Martian rocks in a vast region of the planet's equatorial belt. The purpose of the new experiment will be to determine the content of the principal rock-forming elements -- magnesium, aluminum, sulfur, iron, and other elements, as well as natural radioactive elements -- uranium, thorium, and potassium. This data will make it possible to determine the character of the rocks, their chemical composition and, consequently, the degree of differentiation in the process of their formation. Data on concentration of uranium, thorium, and potassium will be used to study the thermal history of Mars.



Phobos space vehicle orbits around Mars

Key: 1. Mars; 2. Apocenter; 3. That segment of orbit 4 in which space vehicle approaches Phobos and overflies it at a height of 50 m (indicated by heavy line); 4. Path of approach to Mars; 5. Direction toward Earth; 6. Direction toward the Sun; 7. Orbit of Phobos; 8. Orbit

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The project includes a series of experiments involving study of the Martian atmosphere and ionosphere. In particular, plans call for measuring vertical distributions of concentrations of ozone, water vapor, molecular oxygen, dust, as well as vertical temperature and pressure profiles. This information will make it possible to eliminate the presently-existing uncertainty in photochemical models. The principal reasons for variability of individual components will be determined. It may be possible to obtain new data on water reserves on Mars as well as vertical and horizontal transport of water. Measurements of molecular oxygen and carbon dioxide will provide important information on the dynamics of gas exchange between the atmosphere and the polar caps and on the causes of dust storms. Determination of the ratio of deuterium to hydrogen will shed light on the planet's past and will explain the reason for the disappearance of water on Mars.

Investigations of the Martian ionosphere are to be conducted by the pulsed radio-frequency remote sensing method. As we know, at each altitude (this is true of any planet) there is a specific, so-called plasma frequency, which is determined by the concentration of electrons and which determines the conditions of propagation of electromagnetic emissions in the ionosphere. Each ionospheric layer, just as a mirror, reflects radio waves of a specific length. The experiment is grounded on this principle.

In the Phobos project distribution of concentration of electrons by altitude in the Martian ionosphere will be studied by the method of probing it with radio-frequency pulses of increasing frequency from the space vehicle as it travels in orbit around the planet.

Investigation of the Martian ionosphere will make it possible to clarify the question of the nature of the Martian magnetic field. As we know, the solar wind fills interplanetary space -- fluxes of plasma continuously emitted by the Sun. The solar wind is extremely rarefied: a cubic centimeter contains not more than several tens of particles, which do not even collide with one another. The solar wind's magnetic field is also very weak -- it comprises only fractions amounting to 10,000ths of the terrestrial magnetic field at the Earth's surface. Nevertheless planets appreciably react to the solar wind. In addition, interaction between planetary atmospheres, ionospheres, and their magnetic field with solar plasma fluxes comprises a very substantial and quite special area of planetary physics.

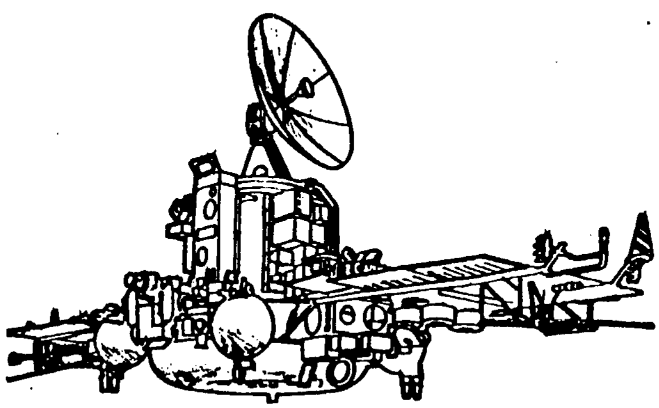

Diagram of Phobos space vehicle.

When the solar wind strikes the Earth's magnetic field, for example, it is stopped at a considerable distance from the Earth's surface: at a distance of approximately 60,000 km at the subsolar point. Our planet's magnetic field is compressed on the side toward the Sun, while the magnetic force lines are "swept" by the solar wind from the day side toward the night side. As a result a cometlike cavity is formed -- the magnetosphere, filled with the Earth's magnetic field. The solar wind does not directly penetrate into this cavity. Thus the Earth's ionosphere is protected against fluxes of solar plasma and behaves essentially independent of this plasma. Our Sun is the principal source of ionization of the atmosphere. Consequently the terrestrial ionosphere will weaken as the Sun sets. The region above the principal ionization maximum begins to compress, while the magnitude of concentration at the maximum and its altitude drop.

An opposite picture is observed on Venus. Since this planet does not have an appreciable magnetic field, under the effect of dynamic pressure by the flux of solar wind, the Venusian ionosphere is compressed from the side facing the Sun and has a sharply-defined upper boundary -- the so-called ionopause. The pressure of the solar wind flux is weaker on the flanks, and the ionosphere expands -- its upper boundary moves away from the planet, rising higher as the Sun sets or as one approaches the terminator separating day and night.

But what takes place on Mars? Does it have its own magnetic field? Analysis of the results of measurements taken by Soviet unmanned probes (U.S. vehicles did not carry such instruments) has enabled us to conclude that Mars does have a magnetic field, but it is very weak. It is apparently tens of thousands of times weaker than the Earth's. For this reason it is not yet clear how interaction between the solar plasma and the planet's ionospheric plasma takes place.

If Mars, just as Earth, is protected by a magnetic field from the solar wind, its upper ionosphere should behave just as the Earth's (or in a similar fashion). If the Martian ionosphere is similar to the Venusian, this means that its magnetic field is so weak that the solar wind "does not sense" its presence.

We know from theory that a planet which possesses its own magnetic field should rotate fairly rapidly and have a liquid core. And in fact, Venus has a period of rotation of approximately 243 terrestrial days. But on Mars days last 24 hours 39 minutes and 35 seconds. At the same time its magnetic field, as already noted, is weak. What does this mean? Is this not evidence of a substantial difference in the internal structure of Mars? Scientists hope that the radar remote sensing of the Martian ionosphere to be carried out on the Phobos mission will help answer these questions.

The probe includes a plasma unit which, as the vehicle approaches the planet and as it travels in orbit around Mars, will provide information on the specific features of solar wind flow and the characteristics of the Martian magnetosphere.

The first investigations of the magnetosphere and its interaction with the solar wind were performed in 1971-1974 by the Mars 2, 3, and 5 unmanned probes. They detected a shock wave and a magnetosphere tail, obtained indications of the existence of a weak Martian magnetic field, and detected hot plasma of planetary origin both within the magnetosphere proper and in the solar wind flowing around it. Present concepts on the outer shells or envelopes of Mars and the processes taking place in near-Mars space were formulated on the basis of the results of analysis of these data. However, due to the fact that earlier Mars probes failed to carry instruments measuring plasma parameters across a broad angular and energy range, scientists do not possess data which enable us to determine the planet's interaction with the solar wind. We can achieve appreciable progress in understanding the physical processes taking place in the magnetospheres of planets only if we possess information on the functions of distribution of charged particles.

The Phobos project includes investigations which will enable us for the first time to obtain a three-dimensional function of distribution of electrons and principal types of ions in the vicinity of Mars and in the solar wind. The experiment method constitutes a further development of mass spectrometric investigations performed in the Soviet-Swedish PROMIX experiments. Selection of electrons will be performed with the aid of electrostatic analyzers and magnetic deflection systems.

Investigations of plasma fluctuations in combination with measurements of magnetic field and plasma characteristics will provide reliable identification of processes taking place in the solar wind flux flowing past a planet and in planets' magnetospheres. In addition, investigations of plasma waves make it possible in many instances to detect new phenomena which cannot be detected by other methods. This feature of wave diagnosis has been demonstrated well, in particular, in investigations performed in the vicinity of the Earth, Venus, Jupiter, and Saturn.

The planned experiment has two important features. First of all one can measure the electrical component of plasma waves in an extremely low-frequency band, in which these waves, as was indicated by measurements taken by the Prognoz 8 satellite, play a determining role in the energetics of processes in a plasma. A combined system of diagnosis utilizing measurements of electric field and variations in plasma flux will provide reliable identification of types of fluctuations. Such experiments have not been performed in the vicinity of Mars in the past.

Magnetometric measurements will be taken by two ferromagnetic-probe magnetometers of closely-similar characteristics.

In order to accomplish comprehensive investigation of Phobos, the mission program calls for the space vehicle to approach its surface to a distance of several tens of meters and to conduct investigations in "grazing flight." During this time investigations of Phobos soil will be performed with laser beam. Thanks to the high accuracy of focus provided by an onboard rangefinder, the energy density in the illuminated spot will exceed 1 million watts. Dust covering the surface in a thin layer will instantly vaporize, and a special mass spectrometer will determine the composition of the particles ejected during this process.

The method employed by the other experiment is based on injecting a flux of krypton ions with a plasma gun. Secondary particles dislodged from the surface soil layer will be analyzed on the basis of their mass spectra recorded by the probe vehicle. (To be concluded)

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DIFFICULTIES IN EXECUTING THE FINAL APPROACH

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 40-41

[Article, published under the heading "Assisting the Flight Commander," by Military Pilot 1st Class Gds Capt A. Ziziko, flight commander: "Final Phase of a Flight"]

[Text] I once witnessed a discussion between young pilots on executing an approach and landing. They held differing opinions on maintaining airspeed, connected with a difference in flying in configurations 1 and 2 on final approach descent. This got me to thinking: are not the seeming contradictions between theory and practice connected with the effect of movement of air masses on flight dynamics in the ground-adjacent layer of the atmosphere?

Let us turn to that section in aerodynamics which discusses flying in the configuration 1 region. We read: if the pilot maintains a specified straight-line path with a change in Vpr from Vpr.ust, a stabilizing resultant force arises, acting on the aircraft in longitudinal relation

$$\text{DeltaP} = P - X$$

and returning it to the initial airspeed without pilot intervention. In configuration 2, however, there arises a destabilizing resultant force which tends to increase the accumulated deviation, and in addition with an increasing rate with increasing divergence from Vpr.ust. Experts in engineering psychology have established that the frequency of changing the point of a pilot's gaze depends on stability of the flight configuration: the less the stability, the more frequent the point of gaze changes. Hence an increase in the required extent of distribution and switching of attention in order to maintain the desired configuration. It is necessary to manipulate the throttle more, including performance of dual motions, in order to maintain the specified Vpr. This means that it is important for the pilot to know during what segment of the approach descent or landing proper the transition from configuration 1 to configuration 2 will occur.

Figure 1 shows the calculated glidepath of an aircraft with Fowler-type flaps. The transition boundaries from configuration 1 to 2 lie along axis Lx and the Vpr change curve. The upper part of the figure corresponds to final approach descent and landing with Fowler-type flaps extended to landing configuration. The lower part of the diagram shows a configuration with flaps in the takeoff setting, which is used, for example, when landing with external underwing tanks. Change in airspeed corresponds to the aircraft operating manual.

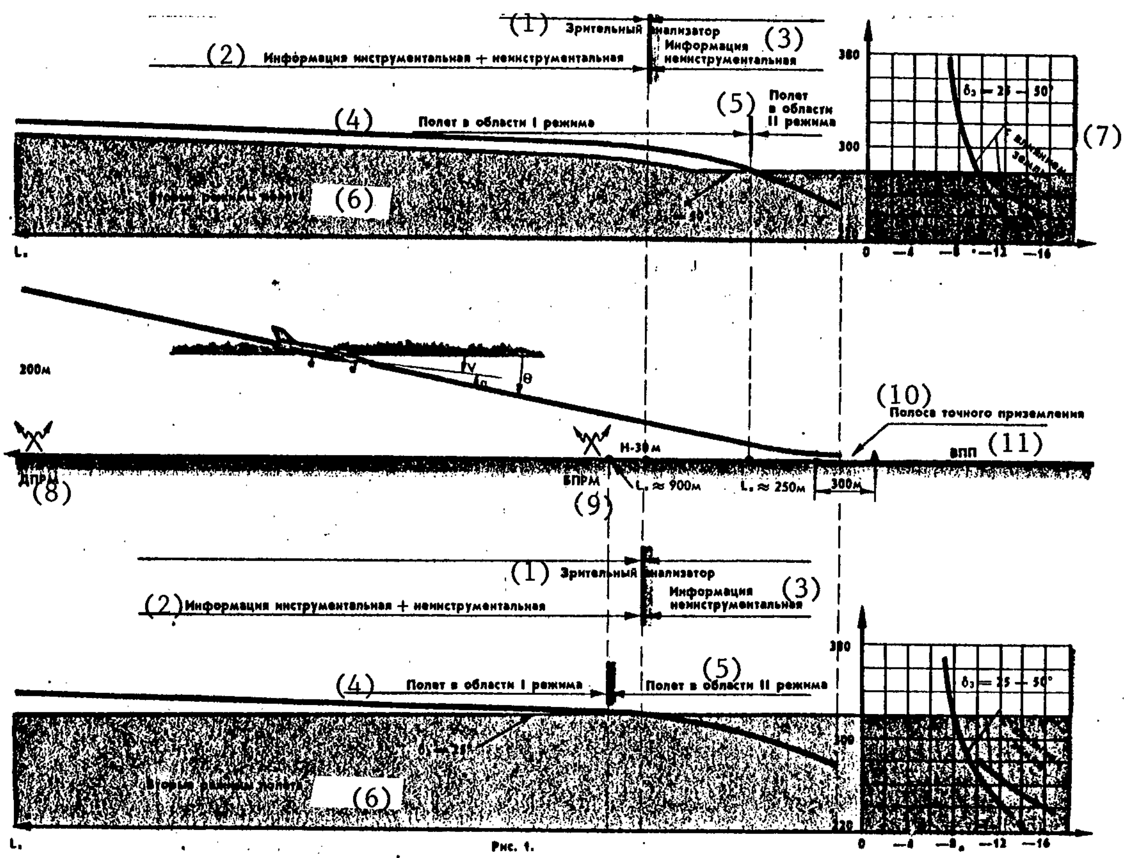

Figure 1.

Key: 1. Visual analysor; 2. Instrument + noninstrument information; 3. Noninstrument information; 4. Flight in configuration 1 region; 5. Flight in configuration 2 region; 6. Configuration 2; 7. With ground effect; 8. LOM; 9. IMM; 10. Landing area; 11. Runway

When flaps are extended to takeoff setting, the configuration 2 region on axis Lx begins much sooner, at a greater distance from the runway, in spite of the fact that the aircraft is descending more rapidly.

Sometimes a commanding officer will cancel flight operations because surface wind velocity exceeds the maximum specified in documents governing flight operations. Sometimes wind conditions are acceptable, but a commanding officer will permit only experienced pilots to fly, while keeping the younger pilots on the ground. What is the reason for such a decision? Is this not overcautiousness? It is not, and here is why.

Difficulty in maintaining a specified Vpr change (Figure 1) and glidepath pattern is different with no-wind conditions and with wind. First of all, if the pilot directs his aircraft toward an aiming point (special marker), its flight path will look like that in Figure 2. From position 1 the aircraft drops below the desired glidepath. Secondly, Theta and V will gradually change in this instance, and therefore airspeed will differ from the desired figure, which in turn requires adjusting engine thrust. In addition, increased difficulty on the final approach descent with variable airspeed in contrast to Vzad=const is connected chiefly not with a decrease in time on glidepath but with the fact that in the first instance the pilot must maintain dVpr/dLx, while in the second instance he need only maintain Vpr. This fact alone indicates an increase in the requisite extent of attention distribution and switching.

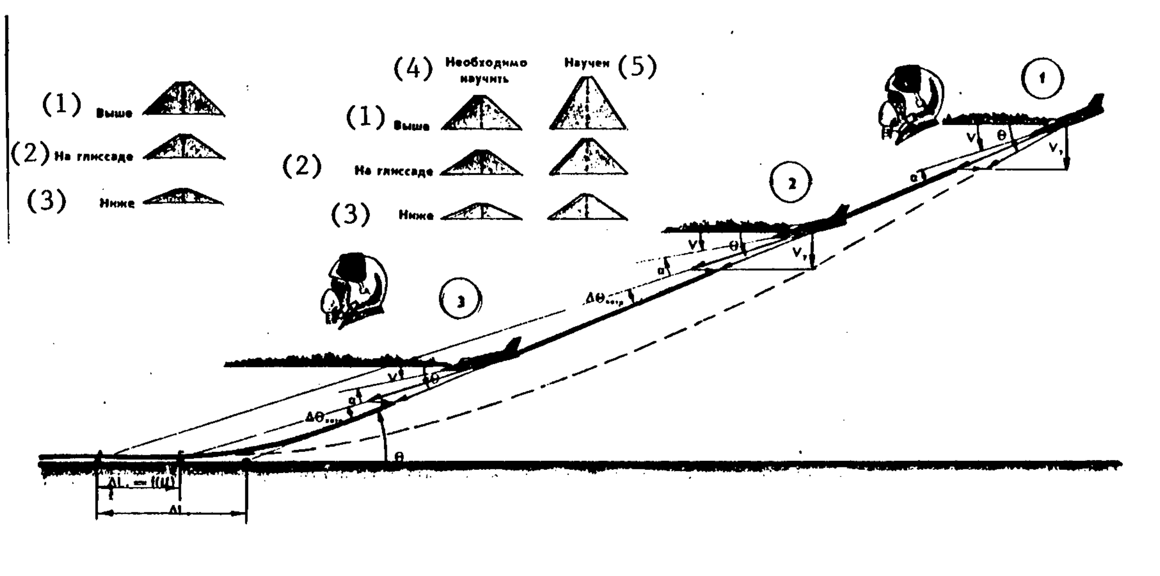

Figure 2.

Key: 1. High; 2. On glidepath; 3. Low; 4. Must be taught; 5. Learned

The degree of difficulty maintaining desired parameters on the glidepath and on landing particularly increases if wind in the ground-adjacent layer is not constant by height and time. In this case gradient dU/dH, as we know from meteorology, is in a specific relationship to wind velocity measured at a standard datum height agl (usually H = 8 -12 m). Thus the greater U-H = 8 - 12 is, the greater change in U in the ground-adjacent layer will be. This means that in order to maintain Theta = const or a specified glidepath and the requisite rate of airspeed decrease, the pilot must change his pitch angle and maintain indicated airspeed in conformity with change in U. It is virtually impossible to predict change in U. The pilot can only respond to a change with appropriate deflections of the controls.

A question arises: when does a pilot, having noticed a deviation from the desired configuration, begin correcting it, and what kind of an error will result? To answer this question, let us analyze the information received by the military pilot, using information diagrams as previously discussed in this journal. With a change in U with decreasing altitude on the final approach descent, information proceeds to the pilot initially from the fourth loop through change in Vpr via the visual-instrument channel. The difficulty in perceiving flight information lies precisely in this, since t4>t3>t2>t1. With a change in the status of the fourth loop, the third loop will not change immediately, since the aircraft possesses inertia. This means that an error may occur from this moment.

With a change in indicated airspeed due to wind, the aircraft's controllability characteristics also change. The pilot perceives this chiefly with the aid of the first, second, and third loops. The first loop comprises forces on the control stick (RUS), and the second loop -- control stick displacement. Consequently only a highly-proficient and experienced pilot can sense a change in airspeed on the basis of change in aircraft controllability.

It has been demonstrated that the structure of attention distribution and switching is determined by practical activity. Well-trained military pilots utilize noninstrument, nonvisual signals to a greater extent. Younger, less experienced pilots, on the other hand, fly primarily on the basis of instrument signals. As a result, due to the fact that change in U is the greatest close to the ground surface, at a height of approximately 30 meters a novice pilot is totally deprived of instrument information (Figure 1), as he transfers his gaze to the left, forward, and downward. For this reason he is delayed in perceiving an occurring deviation from the desired glidepath and only later begins to correct it. If there is a comparatively long delay, the probability of a dangerous deviation increases, and a threat to flight safety arises. On the other hand, an experienced pilot, foreseeing a deviation by his aircraft, is able to intervene in the control process more quickly and can correct the situation.

One must also consider the fact that commencement of flight in configuration 2 in the process of the final approach descent takes place in the immediate vicinity of the ground. Change in wind velocity at this height is considerable. And in connection with a decrease in Vpr, transition to configuration 2 may take place sooner than normal, and in the final analysis the rate of dropoff in Vpr will be greater.

As we see, the difficulty of executing the final approach descent and landing (and these are the most complicated, critical phases of flight) depends in large measure on the characteristics of motion of air masses in the ground-adjacent layer. Therefore before clearing a pilot to fly, the flight commander should carefully consider not only his level of proficiency but also certain aerodynamic characteristics of the aircraft in executing a specific landing. Such a consideration is sometimes subjective in nature. Certain flight commanders rely solely on their intuition in decided whether to allow flight personnel to go up. Since data on wind velocity in the ground-adjacent layer do not provide a complete picture of the motion of air masses, this deficiency is usually made up for with comments by the weather reconnaissance pilot or instructor in the following form: wind is "dense" or "not dense" on the landing approach. This is clearly not enough. A systems approach is required here. The times of "eyeball estimate" are past. Modern aircraft require respect and competent, knowledgeable procedures.

3024
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COMPUTER-CALCULATING AIRSTRIKE TARGET APPROACH MANEUVER

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 42-43

[Article, published under the heading "The Pilot and the Computer," by Military Navigator 1st Class Lt Col V. Yeguyekov: "Calculating Target Approach Maneuver Elements"]

[Text] An aircrew encounters calculations of maneuver elements to approach the target from a specified direction in preparing for each training sortie. This is essential in order to determine the maneuver elements for approaching the target from a specified direction, in order to ensure optimal conditions for penetrating hostile air defense, target detection, aiming and ordnance delivery, and coordination of aircraft or tactical elements in delivering strikes within a limited area. These calculations can involve solving two problems.

In the first problem one determines the distance from the target at which one should commence the turn from one's enroute ground track (Dt), and the length of the flight segment after the turn (S1), from the known values of actual (gamma-phi) and desired directions of approach to the target (gamma-d), approach initiation distance (Da), angle of turn (AT), airspeed (V) and rate of turn [expressed as bank angle] (beta) at the phases of the turn during maneuver execution (Figure 1 on following page).

It is evident from Figure 1 that

$$Д_{отв} = S_1 \cos УР + Д_{вых} \cos \Delta\gamma + R\,(2\sin УР + \sin\Delta\gamma),$$

$$S_1 = \frac{Д_{вых} \sin\Delta\gamma + R\,(2\cos УР - \cos\Delta\gamma - 1)}{\sin УР},$$

where R = V sq / gtg-beta (3) -- aircraft's turn radius, and g=9.81 m/s squared -- acceleration of gravity.

In the second (inverse) problem one must determine, on the basis of known values of turn distance (Dt), distance of approach (Da), actual (gamma-phi) and desired (gamma-d) directions, airspeed (V) and rate of turn (beta), the angle of turn of the flight path during execution of the maneuver (AT):

$$\text{УР} = \arccos\frac{Д_1Д_2 + \sqrt{Д_1^2 - 4R^2 - 2RД_2}}{Д_1^2 - Д_2^2},$$

where

$$Д_1 = Д_{отв} - R\sin\Delta\gamma - Д_{вых}\cos\Delta\gamma,$$
$$Д_2 = Д_{вых}\sin\Delta\gamma - R(1 + \cos\Delta\gamma).$$

In addition, it is frequently necessary to compute the time intervals for approach by various tactical elements to a specified target or to calculate the possibility of simultaneous approach to the target by these elements. In this case it will be necessary to determine the difference in ground track of the aircraft (DeltaS) with execution of a turning maneuver and when flying a straight-in approach.

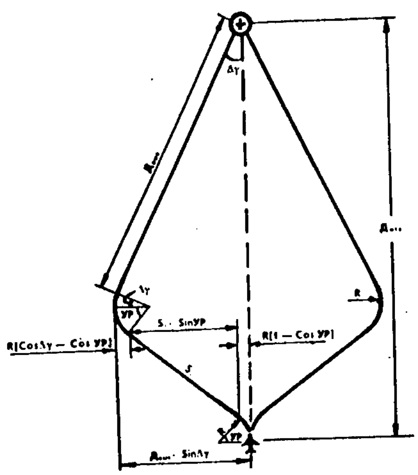

Figure 1.

$$\Delta S = K \cdot R(2\text{УР} + \Delta\gamma) + S_1 + Д_{вых} - Д_{отв}, \quad (7)$$

where

$$K = \frac{1}{57{,}3}\left(\frac{1}{\text{град}}\right) -$$

degrees to radians conversion coefficient.

As we see, calculation of the maneuver on the basis of the above-listed relations requires a large number of operations. Programmable calculators can be very helpful in performing such calculations. Tables 1 and 2, for example, contain programs for calculating quantitites S1, Dt, DeltaS (Table 1, on page 67) and AT (Table 2, on page 68), with corresponding instructions on running these programs on the MK-54 (B3-34, MK-56, MK-61).

Table 1.

(1) Адрес	(2) Команда	(3) Код	(1) Адрес	(2) Команда	(3) Код	(1) Адрес	(2) Команда	(3) Код
00	Flg	1E	24	ИП2	62	48	×	12
01	ИП5	65	25	Fsin	1[	49	+	10
02	×	12	26	ПД	4Г	50	С/П	50
03	ИП4	64	27	ИП1	61	51	/-/	0L
04	3	03	28	×	12	52	ИП1	61
05	.	0 -	29	+	10	53	+	10
06	6	06	30	ИП3	63	54	ИП7	67
07	÷	13	31	Fsin	1[	55	+	10
08	FX^2	22	32	ПС	4[	56	ИП0	60
09	↔	14	33	÷	13	57	↑	0E
10	÷	13	34	П7	47	58	ИП3	63
11	П6	46	35	С/П	50	59	×	12
12	2	02	36	ИПА	6—	60	2	02
13	ИП3	63	37	×	12	61	×	12
14	Fcos	1Г	38	ИП1	61	62	↔	14
15	ПА	4-	39	ИПВ	6L	63	ИП2	62
16	×	12	40	×	12	64	×	12
17	1	01	41	+	10	65	+	10
18	—	11	42	ИПС	6[	66	ИП6	66
19	ИП2	62	43	2	02	67	×	12
20	Fcos	1Г	44	×	12	68	+	10
21	ПВ	4L	45	ИПД	6Г	69	С/П	50
22	—	11	46	+	10			
23	×	12	47	ИП6	66			

Key: 1. Address; 2. Instruction; 3. Code

Instructions on using program 1:

1. F PRG, load program, F AVT, V/O. Toggle GRD to position G.
2. Load registers: K = 0.0175 (1 / degree) into P0; Da(M) into P1; Delta-gamma-degrees into P2; AT-degrees into P3; V(km/h) into P4; g=9.81 (M/s squared) into P5; beta into X register; operation registers -- P6, P7, P8, PB, PD.
3. S/P, S1 into X and P7 registers.
4. S/P, Dt into X register.
5. S/P, DeltaS into X register.
6. With a new bank angle (rate of turn) beta, place it into X register, V/O, and go to line 3.

Instructions on using Program 2:

1. F PRG, load program, F AVT, V/O.
2. Load registers: Dt (M) into P0; Da (M) into P1; Delta-gamma-degrees into P2; V (km/h) into P4; g=9.81 (m/s squared) into P5; beta into X register; operation registers -- PA, PB, PC, P6, P7, P8, P9.
3. S/P, result AT into X register.
4. With a new bank angle value beta, enter it into X register, V/O, and go to line 3.

Table 2.

(1) Адрес	(2) Команда	(3) Код	(1) Адрес	(2) Команда	(3) Код	(1) Адрес	(2) Команда	(3) Код
00	Ftg	1E	21	×	12	42	ПА	4–
01	ИП5	65	22	–	11	43	FX²	22
02	×	12	23	ИП1	61	44	ПС	4[
03	ИП4	64	24	ИП2	62	45	+	10
04	3	03	25	Fcos	1Г	46	F√	21
05	.	0–	26	П8	48	47	ИП9	69
06	6	06	27	×	12	48	×	12
07	÷	13	28	–	11	49	ИПА	6–
08	FX²	22	29	П9	49	50	2	02
09	↔	14	30	FX²	22	51	×	12
10	÷	13	31	ПВ	4L	52	ИП6	66
11	П6	46	32	+	10	53	×	12
12	FX²	22	33	ИП1	61	54	–	11
13	4	04	34	ИП7	67	55	ИПС	6[
14	×	12	35	×	12	56	ИПВ	6L
15	/–/	0L	36	1	01	57	+	10
16	ИП0	60	37	ИП8	68	58	÷	13
17	ИП6	66	38	+	10	59	Farccos	1–
18	ИП2	62	39	ИП6	66	60	С/П	50
19	Fsin	1[	40	×	12	61	П3	43
20	П7	47	41	–	11	62	ИП6	66

Key: 1. Address; 2. Instruction; 3. Code

We should note that in addition to determining AT, it may be necessary to calculate the length of the flight segment following the turn (S1). Load that segment of the program in Table 1 with addresses 12-35 into the PMK as a continuation of the Table 2 program, beginning with address 63. Add line 3a to the instructions: S/P, result S1 into X register.

Example. Two strike elements flying on the same route are assigned the mission to deliver a simultaneous strike from two directions in a 30 degree sector. We must determine the required linear forward spacing between elements during enroute flight and the distance at which turn is to be executed, if the following are known: distance of commencement of target approach maneuver Da=170 km, airspeed 950 km/h, bank angle during turn 30 degrees, angle of turn 70 degrees.

Following the instructions accompanying Table 1, that is, entering the following into the PMK memory registers: 0.0175 (1 / deg.) into P0; Da = 170,000 m into P1; Delta-gamma = 30 degrees into P2; AT = 70 degrees into P3; V = 950 (km/h) into P4; 9.81 (m/s squared) into P5, and beta = 30 degrees into the X register, the following results are displayed: 74989.755 -- (S1); 202127.23 -- (Dt); 79440.593 -- (Delta-S).

Thus in order to deliver a simultaneous strike in the given conditions, the strike elements should maintain a linear forward spacing of 79 km. In order to ensure target approach within the specified sector, the lead element should execute a 70 degree turn at a bank angle of 30 degrees at a distance of 202 km from the target and, after traveling 75 km in straight line, change heading toward the target. The second element should proceed to the target without changing heading.

* * *

Col V. Mamoshin, doctor of technical sciences, comments on the above presentation by Military Navigator 1st Class Lt Col V. Yeguyekov.

The process of formulating a problem for solving on any computer, including programmable microcalculators, usually includes the following stages: formulation of the problem, preparation of an algorithm, writing and debugging the program, and preparing documentation on the problem.

In the above materials prepared by Lt Col V. Yeguyekov, one of the principal stages has been omitted -- preparing the problem solution algorithm. The fact is that the lack of an algorithm makes it difficult for one to understand the program without assistance, and therefore to understand the process of solution and possibilities of improving the program.

Flight personnel are constantly encountering algorithms in their daily work. For example, an aircraft operating manual for crew members is essentially a collection of verbal algorithms which regulate the structure of actions by crew members in performing the required operations under various conditions.

Linear algorithms are among the simplest. They prescribe sequential execution of simple actions (instructions), which are carried out only once. The executing individual cannot proceed to the following instruction until he has completely executed the preceding one. Thus only sequential execution of algorithm instructions in a finite number of elementary actions (steps) leads to problem solution.

The direct and inverse problems presented in Lt Col V. Yeguyekov's article are linear problems. The program for determining angle of turn prescribes the following sequence of operations: enter input data, determine R with formula (3), then sequentially determine (-4R squared), D1 with formula (5), D2-1-4R squared, D2 with formula (6) and, finally, determine angle of turn with formula (4). Finally, display the angle of turn value on the PMK display.

One can easily and graphically represent the algorithm with a diagram, employing the appropriate GOST 19.003-80 symbols. Then the algorithm for solving the problem in question can assume the form shown in Figure 2. It is evident from the figure that according to GOST the beginning and end of the program (elements 1 and 8 of the algorithm diagram) are depicted with ovals, data input and output with parallelograms (elements 2 and 7), while the computation process is represented in the form of rectangles (elements 3, 4, 5, and 6).

Thus, with a problem solution algorithm diagram, it is considerably easier to write a program. We have discussed a linear problem algorithm. The majority of situations arising in the course of aviator combat training, however, require logical analysis. We shall cite an example. IF during engine startup on the L-29 aircraft exhaust gas temperature exceeds 700 degrees C (engine start from an external power source) or 750 degrees (start from aircraft battery), THEN engine start should be aborted, to accomplish which one must switch off and then switch on the circuit breaker marked "Dvigatel" [engine], followed by closing the fuel shutoff valve. Repeat the engine start sequence only after determining that the external power source is providing normal voltage and after correcting the causes of the excessive exhaust gas temperature.

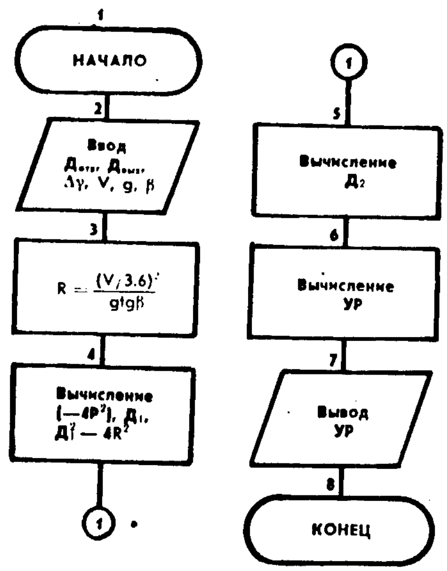

Figure 2.

Key: 1. Start; 2. Input; 4. Computation; 5. Computation; 6. Computation of angle of turn; 7. Angle of turn output; 8. End

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The sequence of pilot actions in this case depends on checking that specified conditions have been met. Algorithms in which an operation or group of operations may be carried out depending on certain conditions are called branching algorithms. As we can see, such algorithms employ the keywords "IF..., THEN...," (emphasis-marked in the text), which perform the function of compound statements which define the sequence of subsequent operations.

Branching commands can be represented as follows:

```
IF          condition
THEN        series 1
ELSE        series 2
ENDIF       (end)
```

For the example in question, the branching command may also be used in an abbreviated form:

```
IF          condition
THEN        series
ENDIF       (end)
```

In a graphic representation of algorithms, the condition can be viewed as a question to which a yes or no answer is possible. Figure 3 (see following page) contains a diagram for a complete and abbreviated form of representation of branching commands. According to GOST, the branching conditions is placed

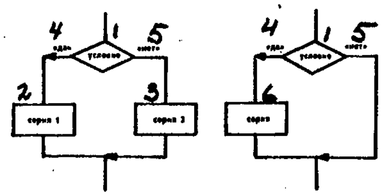

Figure 3.

Key: 1. Condition; 2. Series 1; 3. Series 2; 4. Yes; 5. No; 6. Series

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in a rhombrohedron. If the condition is fulfilled, the information flow line proceeds in the yes direction, and if it is not met, it proceeds in the no direction.

3024
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IMPORTANCE OF HONORABLE CONDUCT BY OFFICERS STRESSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 86 (signed to press 3 Oct 86) pp 44-45

[Article, published under the heading "Implementing the Decisions of the 27th CPSU Congress," by Col V. Lebedev: "One Should Not Forego Honor"]

[Text] I once happened involuntarily to witness a conversation dealing with an Air Force matter. The telephone rang in the office of the chief of the Air Forces Personnel Directorate. The lieutenant general of aviation took the receiver and proceeded to listen attentively.

From the tone of his voice and the expression on his face it was easy to guess that the career of a young officer, a recent service-school graduate, was being discussed. It was no easy task for Yuriy Vasilyevich Simakhin to convince the "suppliant" that he was proceeding incorrectly, that he was being guided in this instance not by the interests of the state but rather by sentiments of kinship and mercenary considerations.

The chief of the Air Forces Personnel Directorate showed considerable patience and self-control, but he would not retreat from his principles.

After hanging up, Yuriy Vasilyevich stated with agitation in his voice: "One still encounters people who use every possible pretext to find a choice job assignment for a relative or acquaintance. I just don't understand such people...."

He paused for a moment, as if gathering his thoughts, and then said: "I have been in the Air Forces for almost 40 years. I flew for a great many years. And not once did I ask anybody to select me for a 'plum' assignment. The dignity and honor of an officer went above all else...." The lieutenant general uttered these words with pride and inspiration.

He then stated indignantly: "It may be isolated instances, but it happens. Take officer V. Kotov. Once the matter of his assignment to a remote area was being considered. These areas still have problems with housing, and not every officer has nice quarters. But military airmen are serving conscientiously in these areas as well, deeply cognizant of their duty to the homeland. They know that the Soviet State and the command authorities are constantly concerned about them. Special benefits have been adopted for this reason. And it is not mere happenstance that many of this year's service-school graduates expressed the wish for duty assignments precisely in these areas.

"Kotov proceeded in a quite different manner. He tried to find as many different reasons as possible why the personnel people should not consider him as a possible candidate.

"The fact is that if an officer does not possess the basic concepts of military honor, he cannot be an example for those around him, and he cannot teach and indoctrinate others, for it is precisely military honor which reflects, just like in a mirror, a person's capability to display self-sacrifice, self-possession, and courage consistently and over an extended period of time. Many airmen possess these qualities, honorably and worthily carrying out their military duty to defend our socialist homeland both in wartime and in peacetime, for true courage is proved when it is put to the test. The more difficult the ordeal, the more spiritual and physical strength is needed. True courage is like an invisible weapon of moral strength, enabling one to turn thoughts into deeds and aims into actual accomplishment."

The history of our Air Forces contains a great many brilliant, unforgettable, truly heroic careers of officers and general officers -- genuine defenders of the homeland. The Soviet people will remember forever those commanders and winged commissars who were the first to take to the flaming war skies, leading air warriors into the fray. Officer-aviators displayed on all fronts of our nation's battle against the fascist invaders an unwavering courage, heroism, and will to win, a high degree of military skill and organizing abilities.

The interests of the service, not finding a "cozy" spot, were always uppermost for these people. They served wherever they were most needed, wherever the command authorities sent them. The process of development of young officers takes place more rapidly at distant posts, at remote military garrisons. At these locations they more quickly acquire independence and self-confidence, those essential volitional and moral qualities which subsequently will help them more fully manifest their abilities and help them defend the homeland in a worthy manner.

Soviet citizens are familiar with the exploit of fearless fighter pilot Aleksey Maresyev. His character was formed in a workforce in which the lad worked as a lathe operator. He arrived in Komsomolsk-na-Amure with the first detachment of Soviet youth envoys. It was here where the young construction worker first flew, several years later. From here he departed on Komsomol travel orders to attend the Bataysk Military Aviation School for Pilots.

When the Great Patriotic War began, Maresyev took part in the fighting on the Northwestern Front, and downed four fascist aircraft. His fighter was crippled in an air-to-air engagement. The gravely-wounded pilot landed his damaged aircraft behind enemy lines and crawled for 18 days toward friendly lines.... At a military hospital, both of Aleksey's legs were amputated below the knee. Displaying unusual stick-to-itiveness and strength of will, he not only learned to walk on prostheses but also went back to flying a fighter plane. At the pilot's request, he was once again assigned to the fighting forces. He fought the enemy bravely on the Kursk Salient, and later in the Baltic. He shot down seven more enemy aircraft. In June 1944 A. Maresyev was made a check pilot with the Air Forces Higher Military Educational Institutions Directorate.

Following discharge from the Armed Forces, Maresyev completed studies at the CPSU Central Committee Higher Party School, and completed graduate studies at the CPSU Central Committee Academy of Social Sciences, and successfully defended his candidate's dissertation. Hero of the Soviet Union A. Maresyev celebrated his 70th birthday this year. But Aleksey Petrovich is still active. He is serving as first deputy chairman of the Soviet War Veterans Committee.

Life in the Air Forces today is replete with examples of nobility, self-sacrifice, and purposefulness on the part of Air Force officers and their dedication to their chosen profession. And wherever Soviet officer-aviators are sent, in whatever distant corner of our land they perform their difficult service, the interests of security of the socialist homeland, a high degree of professional competence and combat readiness are of foremost importance to them. And in present-day conditions the criteria for evaluating professional competence and combat readiness are very strict. They include a high level of ideological conviction, excellent military and technical proficiency, flawless efficiency in all things, precise and conscientious observance of the requirements of the military oath of allegiance and military regulations. And he who unswervingly adheres to these lofty principles does not renounce them, achieves substantial results in his military labor, and proceeds surely along the path of his chosen career.

Once when I was traveling on official business to the air forces of the Red-Banner Far East Military District, I became acquainted with officer V. Vikhrov, his unit's engineer for aircraft equipment. He proved to be not only a capable specialist but also an interesting conversation partner. Viktor Timofeyevich had nice things to say about his men. At that time the airmen were working to master a new aircraft. They were working from dawn to dark, as they say. Both flight personnel and engineer-technician personnel had plenty to do.

Vikhrov's father had been a fighter pilot, who had flown hundreds of combat missions during the war. Timofey Georgiyevich had fought courageously in the skies over Spain and had taken part in the fighting on the Khalkhin-Gol River. He had been awarded the Order of Lenin, four times the Order of the Red Banner, the Order of the Red Star, medals, as well as decorations of the brother Mongolian People's Republic.

Vikhrov junior had become accustomed from childhood to the rhythm of life on an air base. Even as a child Viktor had dreamed about flying. Persistent and purposeful, he did well in school, went out for sports, and built model airplanes. The lad had plenty of natural ability, but even for him things were not always easy. He relied on himself alone and did not even turn to his father for assistance -- he proceeded independently toward his chosen goal.

Upon completing the 10-year school, Viktor decided to enroll in flying school. Luck was not with him, however: the medical examining board closed for him the possibility of a flying career. A thorough medical examination determined that his eyesight was below the required standard. This brought a question: what should he do now? It was not in his character to give up his dream. And he made a firm, final decision: to enroll at a higher military aviation engineering school, in electrical engineering. Vikhrov worked hard preparing for the entrance exams, and he was successful: he was accepted as a cadet.

From the very first day Komsomol member Vikhrov devoted himself entirely to his studies, endeavoring to use each and every hour profitably. He was considered the top cadet at his school. He earned his aviation engineering diploma with honors. Naturally Vikhrov had the right to choose his duty assignment. He could also count on support from elsewhere. The young officer requested to be sent to the Far East, however, to an air base located close to our national borders.

His fellow officers soon saw that Vikhrov was truly a knowledgeable engineer, a demanding individual of high principles and, most important, a very conscientious person. His reputation rapidly grew. He received job and rank promotions one after the other. I happened to be present when they were discussing a new job assignment for this officer. One of his superiors stated: "Party member Vikhrov has done an excellent job. I am confident that he will also not let us down in this new position...."

This officer's success has not come automatically. It has been achieved at the cost of a great deal of work and exertion of all his mental and physical energy and the ability firmly to stand up under the harshness and severity of military life.

Profound knowledge on the part of each and every officer, a high level of education and culture, breadth of political and military knowledgeability, an understanding of the laws governing the class struggle, the processes taking place in the course of restructuring in all domains of our society, as well as the laws and mechanisms governing the development of military affairs -- all these things are a demand of the times. They compel all individuals thoroughly to analyze the style of their activities, their attitude toward their job, and to approach the solving of difficult problems innovatively and with enthusiasm.

Today there can be no "average" officer in level of training, professional and methodological expertise. This is why an officer, as an organizer and indoctrinator, and as a specialist, is called upon to display a personal example in combat training, in discipline, as well as during off-duty activities, must strictly observe our communist ethics and morality and hold dear his honor and the finest traditions of the officer corps of the Soviet Armed Forces. Particularly since there occur many situations in the important job activities of each and every officer when it is absolutely necessary to defend a correct point of view, to have the ability to speak openly and candidly with one's subordinates and, when necessary, to call them strictly to account. It also sometimes happens that an officer is required to speak out against injustice or, on the contrary, honestly to admit his error. It is sometimes necessary to subject oneself to criticism, to go against stagnant traditions and relics of the past, and to express one's opinion frankly, even if it is at odds with the opinion of a person in higher position.

In all these as well as in a number of other circumstances the officer-leader must be honest, objective, and fair toward his men. His integrity, modesty, aggressive experiential posture, faithfulness to duty, and officer's honor are also manifested in this.

Unfortunately one still encounters leader personnel who, barely after assuming a new position, proceed to think only about their own personal benefit, forgetting about honor and dignity.

The Marxist-Leninist concept of honor differs radically from the bourgeois concept. This finds expression in our first military regulations adopted following the Great October Revolution. For example, honor was defined as follows in the "Red Armyman's Book" and in the new disciplinary regulations of the Workers' and Peasants' Red Army: "Revolutionary military honor is awareness of one's own dignity as a revolutionary serviceman of the Workers' and Peasants' Red Army and a citizen of a free country who is conscientiously carrying out his duty."

"Who is conscientiously carrying out his duty".... If we give thought to these content-filled, profoundly meaningful words, we shall note that they contain a main element -- a class, revolutionary definition of honor as wholehearted, conscientious performance of one's duty to our socialist society.

The category of military honor reveals a person's relationship to himself and the relationship of others and society toward him, in conformity with an individual's specific merits. The concept of honor presumes a measure of respect toward a person, and those honors which he has earned by his deeds. It is like a fragile vessel which is carefully protected and preserved. It is for this reason that it is easier for people to take failures than denigration of honor.

The honor of an individual serviceman is a part of the honor of the regiment. "It is necessary," stated M. I. Kalinin, "that each and every conscript, upon reporting for duty to his assigned regiment, knows not only its designation number but also its entire combat history, all its heroes and combat decorations, its honors and citations earned in combat, as well as all its victories in competitions and on field maneuvers, so that he is proud of his regiment and always defends its honor." Today's generation of airmen proceeds precisely in this manner.

Military Pilot 1st Class officer V. Kopchikov serves in a certain unit. At one time, as a member of a helicopter squadron which was under the commander of officer V. Shcherbakov, who was subsequently awarded the title Hero of the Soviet Union, he was carrying out his patriotic and internationalist duty in the DRA. Squadron Depty Commander for Political Affairs Vladimir Fedorovich Kopchikov proved himself to be not only an able indoctrinator but also a skilled pilot.

...The Soviet helicopter crews landed at an unfamilar airfield. Things were busy right from the outset. One sortie followed another. The character of the Soviet airmen who had come to the aid of their friends the Afghan people was revealed even more vividly in this difficult situation.

Once it was necessary to deliver bread and water supplies on an urgent basis to persons being victimized by hostile fire. The commanding officer assigned this critical mission to party member Kopchikov's aircrew. Although it was very dangerous to expose themselves to intense dushman [Afghan rebel] machinegun and assault-rifle fire, the crew accompished the mission brilliantly. Officer Kopchikov flew more than 500 combat training sorties in the skies over Afghanistan. At his initiative publicity for the achievements of leading aircrews, the experience and know-how of the finest pilots, navigators, flight technicians [crewchiefs], and other specialist personnel was organized in the squadron.

Lieutenant Colonel Kopchikov's military labor was duly honored by the homeland: he was awarded the Order of Lenin and the Order of the Red Banner. The majority of Soviet Air Force officers are equally devoted to their job. They are profoundly aware that defense of the homeland, the achievements of socialism, and the peaceful labor of the Soviet people is a matter of honor for them.

In 1918, when the Soviet Armed Forces were being formed and organized, V. I. Lenin stated: "Only Red officers will enjoy authority and respect among the men and will be able to consolidate socialism in our army. Such an army will be invincible." History confirms the profound correctness of these words.

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