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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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

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Antirocket Defense

In the World of Science and Technology

From the History of PVO Troops

Criticism and Bibliography

Defenders of the Leningrad Sky--by I. P. PETROV (Page 2)

Summary:

Fighter aviation personnel in the Leningrad area greet Aviation Day with a good record in training and service.

A squadron commanded by Maj PLESHKOV is maintaining its "excellent" rating.

A squadron commanded by Maj NIKOLAYEV has a ten-year accident-free record. His deputy commander, Capt GASONOV; flight commander, Capt CHENDALOV; Capt KARTAVYKH and others are experts on aviation equipment and experienced air combatants.

The squadron personnel have high praise for Capt Tech Serv SHLAPAK, chief of a technical operations chast'; Officers YEREMENKO, TALALAY, TRIFONOV and other aviation specialists who perform maintenance on their equipment.

Sr Tech-Lt GOLUBENKO was awarded a valuable gift for his exceptional vigilance. During the refueling of a fighter plane, he detected a foreign mixture in the fuel, thereby preventing a possible air disaster.

Clearly, Quickly, Accurately--by Maj V. S. LEVITSKIY (Page 2)

Summary:

Maj KHUDYAKOV has successfully directed hundreds of interceptions of air targets. He works clearly, quickly and accurately, remains calm in any situation, and is highly respected by his subordinates and superiors.

Once, just as an interceptor was about to turn on a target, the blips from the target and interceptor disappeared from the screen of the PPI. KHUDYAKOV quickly evaluated the situation, analyzed the course and speed of the plane, etc., and accurately directed the interceptor to the target.

Work Constantly With Reenlisted and Experienced Soldiers -- Editorial (Pages 3-7)

Summary:

Reenlisted and experienced (two or more years of service) personnel are the military assistants of officers in training soldiers and developing in them a high sense of responsibility toward their duties. The majority of servicemen in these categories are outstanding soldiers, experts on equipment and masters of their specialties. It is to them that young soldiers look for examples and from them that they learn.

* In order that reenlisted and experienced personnel may be depended on, it is necessary to work with them constantly and to raise the level of their political and military technical training so that they have a good background in political theories and a thorough knowledge of equipment and methods of training and educating subordinates.

The most effective training is that in which reenlisted personnel comprise a special group and are instructed by the best and most knowledgeble officers among the podrazdeleniya commanders and staff officers. Training reenlisted sergeants with sergeants having less experience inevitably leads to repetition of the same thing from year to year. This does not increase their knowledge and tends to lower their interest.

Seminars and lecture sessions for reenlisted and experienced personnel have been conducted in a number of chasti and have proven very beneficial. Participants in seminars and lecture sessions listen to speeches by master sergeants and commanders of crews and squads who have distinguished

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themselves as leaders.

Meetings of officers and reenlisted personnel should be held for the purpose of evaluating training, analyzing disciplinary practices, uncovering deficiencies, and adopting corrective measures. These meetings enhance the role of reenlistees and help them acquire command qualities and skill in educational and disciplinary work.

Political organs and party and Komsomol organizations are called upon to actively support commanders in training and educating reenlisted and experienced personnel. They have a special responsibility for broadening their political horizons. Sergeants should be persuaded to study at evening party schools and evening universities of Marxism-Leninism so that eventually every reenlistee will have completed an evening school for adults and have passed an examination certifying his political maturity.

In some chasti there is little evidence of concern for the daily welfare of the reenlistee. This situation is completely inexcusable and those who are jealous in their treatment of reenlisted personnel should be firmly dealt with.

<u>A Revision Dictated by Life</u> -- by Col Gen Arty Yu. P. BAZHANOV (Pages 8-11)

Summary:

The training program for military engineers needs to be revised. Training in mathematics and certain specialized areas does not meet contemporary demands and many of the engineering disciplines being taught have no practical value for engineers.

During the last three years, certain steps have been taken to improve the training process in academies. Such general engineering disciplines as general chemistry, the resistance of materials, and theories of mechanics and machines have been dropped from the training programs. More time has been devoted to mathematics, physics, and technical and specialized disciplines. A course in the theory of probability has been expanded, and a course in physics and the principles of radio engineering and radar have been revised. A course in operation and tactical training now includes elements of operations analyses.

The practical training of future engineers has also been improved by the introduction of new assembly, experimental, and maintenance practices and compulsory attendance of a fourth course in scientific work. The repair of assemblies in which malfunctions have been artificially introduced has been eliminated. Repair practice is now based on preventive maintenance with tuning and adjustments being made as they become necessary.

The majority of academy students participate in the work of military science study groups. The themes of their scientific work are coordinated with/the training plan and reflect comtemporary questions in the fields of radio engineering and radar, automation, and computer equipment.

Students participating in the work of student design offices have developed a number of devices to improve combat training and scientific research in academies.

There are, however, many deficiencies in the organization and execution of work in military science study groups and design offices. The topics for study and rresearch which are assigned students are not always interesting and concrete. There are shortcomings in the supervision of this work and the material facilities are often insufficient.

The main problem facing academies is the preparation of highly qualified specialists. New divisions and sometimes even new branches of science must be included in the training plan as the need arises. At the same time, secondary disciplines should be eliminated to allow more time for study in specialized areas.

Party and Political Work in Military Education

Conduct Reports and Elections Meetings of Party Organs On a High Level

Summary:

The party organizations of the Soviet Armed Forces are again holding meetings for the purpose of electing officers and reporting on the progress of party and political work. At these meetings Communists will discuss means of increasing combat capability and readiness, strengthening military discipline, and improving the education of military personnel.

At these meetings it is important that the secretaries of party organizations be completely objective in their reports. Deficiencies in the work of the organization should not be passed over and the reasons for all shortcomings should be clearly set forth.

Last year many of the reports delivered at election meetings were heavily laden with statistics showing how many lectures, reports, meetings, etc., had been conducted during the year. This should not be the main concern of party committees. They should direct their attention to the quality of educational work and the ideological level at which it is being conducted.

There are still some party organization leaders who are negligent in their duties and who fail to show the proper concern for the political and ideological growth of military personnel. Such leaders often try to protect themselves by omitting certain facts from their reports and glassing over others.

Political organs of soyedineniya and chasti should assist party committees and organizations in conducting election meetings in accordance with provisions outlined by the 22nd Party Congress.

Officers Study and Propagandize Resolutions of 22nd Party Congress -- by Lt Col P. T. SPIRIDONOV (Pages 16-18)

Abstract:

Praises the political organs and party organizations of a fighter aviation chast' for their work in familiarizing officers with the resolutions of the 22nd Party Congress. The following officers are mentioned in the article: Lt Col KOSMINKOV, Lt Col YURCHENKO, Engr-Maj YASHIN, Engr-Maj YEGOROV, Maj NIKFOROV.

When Competition Is Well Organized -- by Lt Col V.N. GOLUBEV (Pages 19-21)

Abstract:

Discusses organizational competition among trainees of a radar company commanded by Capt CHEKHOVSKIY and the role of party and Komsomol organizations in promoting this work.

A Squadron Becomes First Class -- by Maj I. Ye SHIL'NIKOV (Pages 22-24)

Abstract:

Recounts how all airmen in a PVO squadron commanded by Maj POLESHCHUK earned a "first-class" rating in a single training year. The following officers were mentioned in the article: Maj POLESHCHUK, Maj KINKLADZE, Capt Tech Serv BRAZNIKOV, Capt MASLIN, Capt TOLOCHKO, Sr Lt MELKOS'YANETS.

Army Inventors Awarded Prises -- by Lt Col F. V. YUKHNIN (Page 24)

Summary:

Twenty-seven army innovators and inventors were awarded prizes by the Ministry of Defense during an all-army competition to select the best inventions and suggestions of army personnel.

Capt Tech Serv ABACHIN received a first prize for a device which composes and prints cryptograms. This device is now used in the training of radio operators.

Engr-Lt Col KARPOV was awarded a prize for his "airfield thermal harvesting machine." Mounted on an MAZ-200 automobile chassis, the machine is widely used in maintaining airfields both in summer and in winter.

Pfc's TASHLYKOV and KRITSKIY and Pvt CHERNYKH were awarded a first prise for a device which mechanically and electrically tests and adjusts IGI (GIU) selectors for all types of dial telephone exchanges. This compact, convenient device reduced the time required for testing.

Combat Training

Improve Tactical Training of Officers -- by Lt Col T. V. YEROFEYEV (Pages 25-29)

Abstract:

Discusses the importance of maintaining a high level of tactical training for officers of the PVO Strany Troops. He suggests that officers familiarize themselves with the tactics of all branches of service so that they will be better able to coordinate PVO operations with those of other services. He cautions officers against under-estimating the value of map work and tactical training.

For A Good Showing in the Sparktakiada of Troops -- by Col V. S. YUFEROV (Pages 30-32)

Abstract:

Discusses ways to improve the physical training of PVO Strany Troops and outlines plans for sports events, including a spartakiada, to be held in 1962.

Characteristics of Flight in the Second Regime -- by Engr-Lt Col A. A. D'YACHENKO (Pages 33-36)

Text:

In flying, one encounters situations -- although rather seldom, its true -- in which an airplane that has been flying in fixed horizontal flight for a relatively long period of time, suddenly, without any apparent cause, looses its capability to maintain that regime. Sometimes one receives the impression that the engine thrust has dimished while in reality it remains the same. How can this phenomenon be explained. It turns out that the plane has gone into a second regime of flight.

The concept of a second regime of fixed horizontal flight was first introduced by Professor N. Ye Zhukovskiy, who used graphic and analytical methods to establish criteria for defining this regime. These criteria are represented by the difference between the steepness of two curves: the available thrust (P_p) and the head resistance in the regime of fixed horizontal flight (Qg.p.) [g.p. = horizontal flight]. If the two curves at their point of intersection in a graph flow in such a manner that curve Pp passes through a Mach number at a steeper angle than curve Qg.p., the plane is passing into the second regime of horizontal flight. On the other hand, when curve Qg.p. passes through a Mach number at a steeper angle than Pp, a plane flying in a fixed horizontal flight is in the first regime. This definition of the second regime of horizontal flight holds true at all altitudes and Mach numbers at which modern aircraft are flown.

What are the special characteristics of a plane's flight in the second regime in comparison to flight in the first regime of horizontal flight? In order to answer this question it is first necessary to examine the stability and controlability of an airplane in the first and second regimes.

Research in longitudinal stability has shown that the flight of a modern airplane in the second regime of horizontal flight is, as a rule, stable and that this stability is in part related to the speed of the airplane. This may be shown with the help of a graph (figure 1) on which are drawn N. Ye. Zhukovskiy's curves (Pp and Qg.p.) and a curve of an airplane's head resistance at a given altitude (BA), plotted on a constant angle of attack (d). From the figure it may be seen that flight in the second regime begins at angle of attack d_2 and the Mach number of the flight equals M_2 (point B). The airplanes' controls are in a fixed position. It is supposed that this provides a balance of longitudinal moments acting on the plane.

Let us examine a situation in which an involuntary change in a plane's flight speed (without a change in the position of the controls) is not accompanied by a change in the longitudinal moments acting on the airplane. The latter means that in this situation an increase in the Mach number to M would not change the airplane's angle of attack d_2. From the graph it may be seen that an involuntary increase in the Mach number creates an increase in thrust and head resistance. The increase in head resistance does not occur according to curve BD of the head

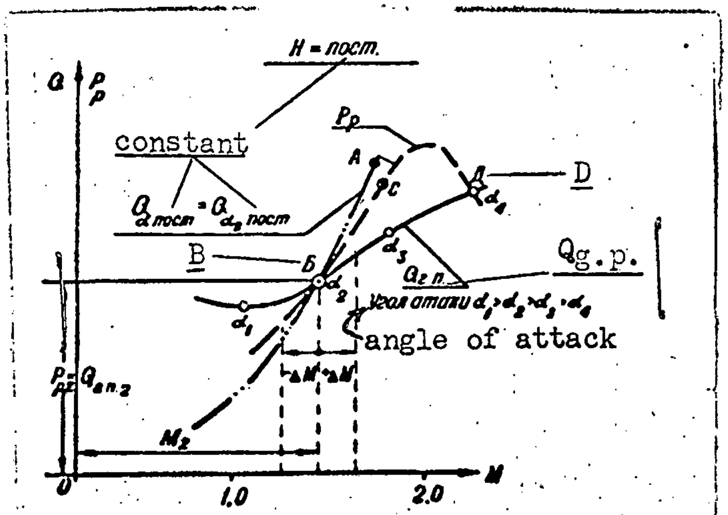

Рис. 1.

resistance of an airplane in the regime of horizontal flight $Q_{g.p.}$, but according to the curve of head resistance plotted on a constant angle of attack d. Curve BA is plotted according to d_2 constant:

$$Q_{d_2 \text{ constant}} = C_{x_{d_2 \text{ constant}}} \cdot \frac{pV^2}{2} \cdot S$$

Since the curve of head resistance $Q_{d \text{ const.}}$ (curve BA in figure 1) for modern airplanes flows through the Mach number of the flight at a steeper angle than the curve of available thrust P_p, the flight in the second regime is stable with respect to speed and is generally stable in a dynamic sense.

However, supersonic, high-altitude flights of modern jets in the second regime of fixed horizontal flight will take place at Mach numbers when the the curve of the change in available thrust according to Mach number $P_p = f_1(M)$ will flow at a steeper angle than the curve of head resistance at a constant angle of attack $Q_{d_2 \text{ const.}} = f_2 \cdot (M)$. In these instances the flight of a plane in the second regime will be unstable.

Thus, curve BA approximates the limit of stability for the second regime of horizontal flight.

Figure 2 shows curves P_p and $Q_{g.p.}$ and the curve of head resistance at a constant angle of attack for the horizontal flight of a plane in the first regime. From the drawing it may be seen that the first regime is also stable since curve BA flows at a steeper angle than BC.

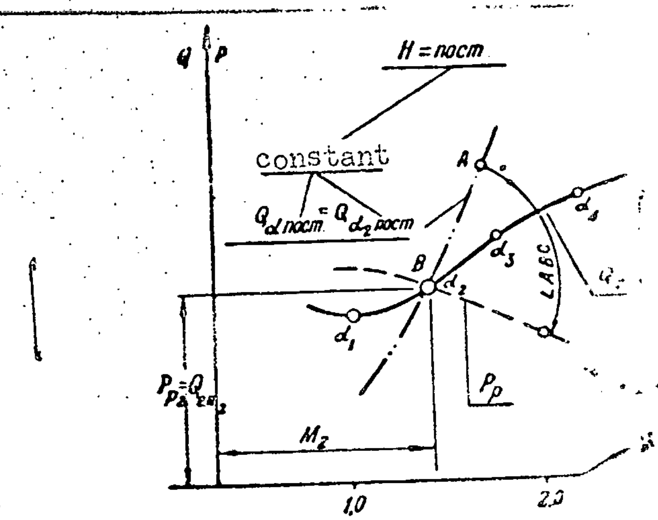

Рис. 2.

Comparing the two graphs (figures 1 and 2) it may be said that a plane's flight in the second regime differs from its flight in the first regime in that it has a smaller margin of stability, which is graphically represented by the size of ABC. Theory and practice show that the greater the size of angle ABC, the faster a plane regains the speed and altitude of its flight following the effects of external disturbances.

It should be pointed out that the law of change according to Mach number of available thrust $P_p = f_1(M)$ at a given altitude is not the only factor which influences the size of the margin of stability of a plane in the regime of horizontal flight. Theory and practice show that if the disturbance in the speed of the plane results in an additional (unbalancing) diving moment, the margin of stability is decreased. Graphically this phenomenon may be depicted as a downward sweep (like the hand of a clock) in the curve of head resistance plotted on a constant angle of attack. $Q_{d\ const.}$ (i.e. a downward sweep at a certain angle of curve BA without a change in the position of the curve of available thrust P_p). If, on the other hand, an involuntary increase in the Mach number results in the appearance of a pitching moment, the margin of stability increases. This means that curve BA (figures 1 and 2) swings upward at a certain angle in relation to point B, i.e. the opposite of a clock hand.

Remember that the appearance of additional diving moments in modern airplanes resulting from an increase in the Mach number of the flight occurs chiefly in the range Mach number $0.9 \div 1.2$. Therefore, conducting flights in the second regime at these Mach numbers is undesirable.

Now let us examine longitudinal controlability in the second regime. It is well known that the longitudinal control of a plane is normally accomplished by manipulating the elevator and regulating the thrust of the engine. Under normal conditions of flight in the first regime, inclining the elevator upward at a certain constant angle results in an increase in the initial altitude of the flight and a decrease in speed. When the trailing edge of the elevator is lowered the initial altitude of the flight is is decreased and the speed is increased. If the pilot increases the engine thrust, an increase in the initial speed and altitude of the flight results. A decrease in the thrust results in a decrease in the speed and altitude of the flight. This reaction of an airplane to the manipulation of the elevators and the regulation of engine thrust is called direct or normal. In the second regime of horizontal flight the direct control of an airplane's altitude through manipulation of the elevator is disturbed (the position of the power control remaining unchanged). The disturbance of the longitudinal control of an airplane's altitude during flight in the second regime occurs not only in the amount, but also in the quality of control. This is graphically illustrated in figure 3. On the graph it can be seen that the altitude and speed of the plane's flight change temporarily before the pilot pulls the control stick toward himself (i. e. when the elevator is inclined upward at a certain constant angle, equal to a). Lowering the trailing edge of the elevator is considered positive, and raising it, negative. At first the flight altitude increases, but after a certain length of time it begins to decrease; the plane slowly but steadily descends. In this situation, a pilot's attempt to correct the flight altitude through the usual methods is unsuccessful. The fact is that in the second regime a decrease in speed is accompanied by a negative rather than a positive surplus of thrust (and with it, the descent of the airplane).

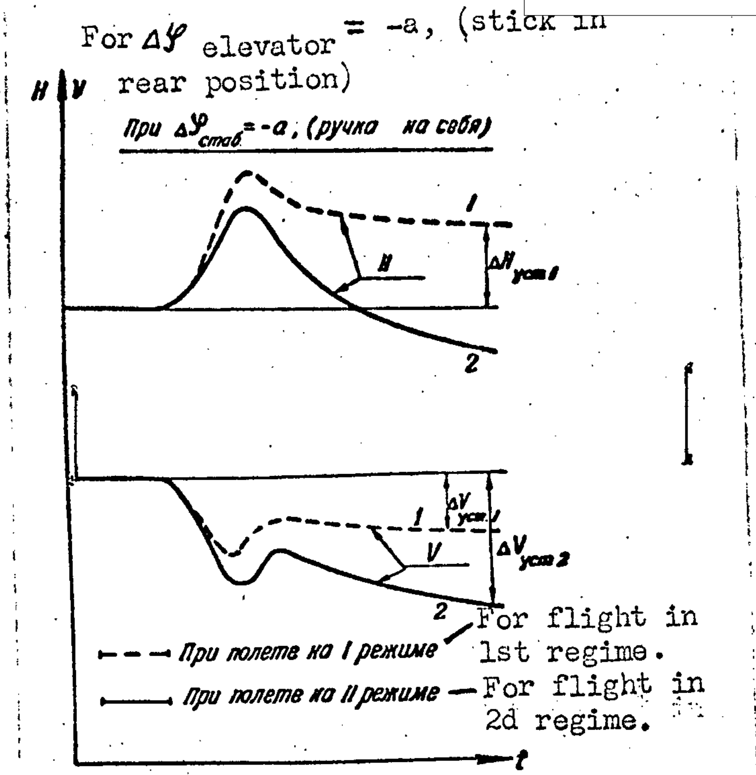

Рис. 3.

If the pilot continues his efforts to correct the altitude by further decreasing the speed, the negative surplus of thrust becomes still greater and the tendency to descend increases. A pilot's attempts to re-establish the desired altitude of the flight by decreasing the speed can evantually lead to loss of speed and stalling of the aircraft.

Of course, under normal conditions of flight in the second regime, losses in speed resulting from a pilot's attempts to maintain a constant altitude by the usual methods are unlikely since a pilot is constantly watching his speed. However, in certain special situations, for example while flying through clouds in a plane having a broken air speed indicator, a phenomenon of this sort is possible. In this situation the pilot sets the engine speed for maintaining horizontal flight and further strives to maintain a constant altitude. If the flight is in the second regime or or near it, the altitude of the flight cannot be maintained by manipulating the elevator and it is necessary to take steps to ensure a safe speed. 50X1-HUM

Figure 3 shows the change in speed and altitude of an airplane's flight in the first and second regimes following adjustment of the elevator, but it does not show how an airplane reacts to the adjustment of the elevator during a flight on the border between them, i. e. when such a flight is represented on the graph by the tangency of the curve of available thrust P_p of the engine with the curve of head resistance in the regime of horizontal flight $Q_{g.p.}$. Calculations show that in this case the plane reacts to the adjustment of the elevator in the following manner: at first it gains altitude but later it begins to descend toward the altitude at which the pilot first adjusted the elevator.

The change in the speed of flight during this process will be qualitatively the same as for flights in the first and second regimes. From a quantitative standpoint the curve of the change in speed, if it were drawn on the graph, would pass between curves 1 and 2.

This change in speed with the adjustment of the elevator means that the transition from flight in the first regime to flight in the second regime is accompanied by an increase in the direct controlability of the airplane, i. e. the speed of flight in the second regime is more responsive to the adjustment of the elevator than in the first regime.

An understanding of an airplane's reactions to regulation of engine thrust may be gained from the data given in figure 4. From the drawing it can be seen that with a certain positive deviation in the position of the power control stick equal to B (i. e. $\Delta\lambda = +B$, thrust increases), the airplane's

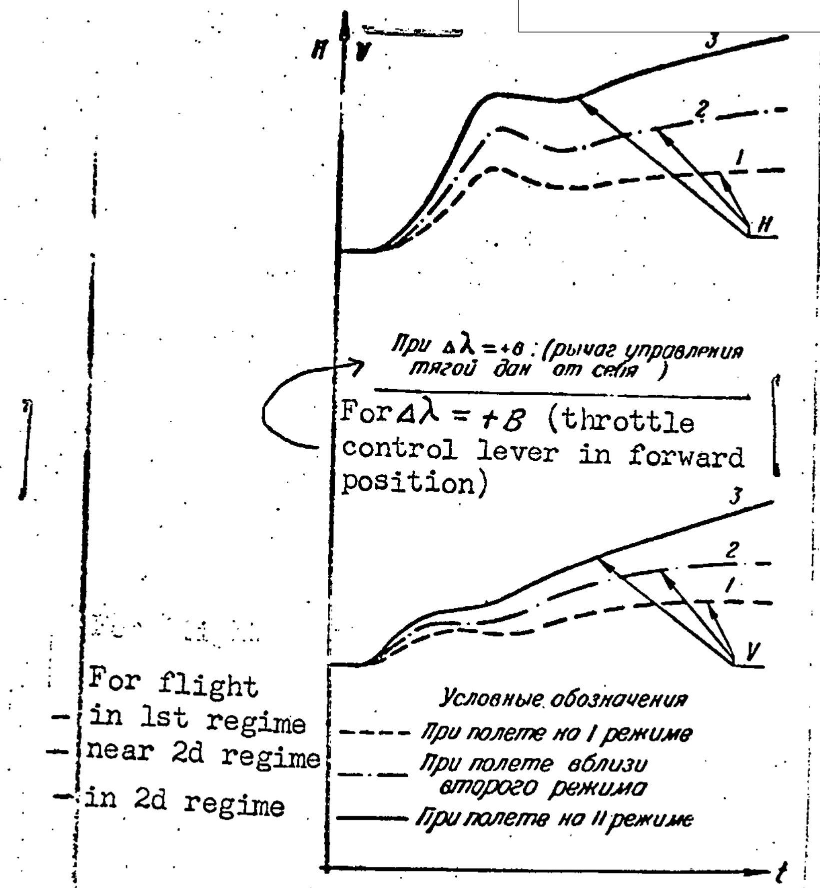

Рис. 4.

flight speed and altitude are increased somewhat, the increase being the same in both the first and second regimes. Thus flight in the second regime does not qualitatively change an airplane's reaction to variations in thrust. however, from a quantitative standpoint it considerably increases the gain in speed and altitude in comparison with a flight in the first regime (assuming that in both cases the increase in engine thrust is the same).

The data given in figure 4 clearly shows that during a flight in the second regime the pilot can successfully correct variations in altitude and speed by changing the engine thrust. Here it must be kept in mind that in a steady flight in or near the second regime an airplane's responsiveness (in speed and altitude) to a change in engine thrust is considerably greater than it is in a flight in the first regime. This distinguishing feature in the longitudinal control of an airplane in the second regime is characteristic both of supersonic flights and flights approaching the speed of sound.

These facts also indicate that if it is necessary for a pilot to make the transition from flight in the first regime to flight in the second regime, this transition can best be made by increasing the engine thrust. Of course, the latter is possible only in those cases where a flight in the second regime takes place below the absolute ceiling. If the flight is in immediate proximity to the absolute ceiling, a transition to the first regime would require the regulation of the elevator to increase the speed of descent.

All of these characteristics of an airplane's behavior in the second regime appear only near the speed of a horizontal flight at which curves P_p and $Q_{g.p.}$ intersect or touch. They do not have a direct influence on the piloting of an aircraft in the unsteady regimes of acceleration and deceleration because of the presence of considerable surpluses of thrust. The aircraft handles normally. During the ascent of an airplane from an altitude of 11000 meters, inclining the elevator upward at a certain constant degree (control stick in rear position) results in a decrease in flight speed and a considerable decrease in the rate of ascent. Remember that in the first regime a similar adjustment of the elevator resulted in a decrease in flying speed and an increase in the rate of ascent. The same is true in the descent of an airplane with engines operating at a constant speed. In this case an upward inclination of the elevator results in a decrease in flying speed and an increase in the rate of descent. In the first regime the rate of descent decreases.

Reverse control of altitude through the adjustment of the elevator is not eliminated in airplanes having automatic pilots designed to control the angle and rate of pitch through the regulation of the elevator. If this automatic pilot has a signal for a variation in altitude, it is necessary to switch it off (i. e. switch off the correction for altitude) before entry into the second regime of flight.

The use of automatic pilots which stabilize an airplane's speed by regulating engine thrust completely eliminates reverse control of altitude in the second regime through the use of elevators. In connection with this, it should be noted that while flying without automatic pilots in the second regime near the absolute ceiling, the pilot must first of all attempt to maintain the desired flying speed, not allowing it to diminish, and watch his angle of pitch. He may successfully accomplish this by regulating the elevator (control stick).

Flight in the second regime is a special case; therefore, in the interest of safety, every pilot should know well its characteristics.

Once More on Note-Taking by Officer Candidates and Methods of Instruction--Editorial (Pages 37-41)

Abstract:

Reviews letters received by the editorial office in response to an article by Engr-Lt Col ZIL'BERMAN entitled Improve Methods of Technical Training of Future Officers, which appeared in the third issue (1962) of the journal. In this article ZIL'BERMAN expressed the opinion that officer candidates should not take notes while studying radar sets but simply listen attentively to the instructor's lectures and observe carefully his demonstrations. He recommended that candidates prepare for lessons and tests by studying summaries prepared by the instructor and given to the candidates in advance. He also suggested that future officers should study methods of locating and repairing defects in radar sets rather than simply studying how to repair "typical" defects.

Letters by Major KHOD, Engr-Lt Col PORTNOY, Engr-Capt ISHMATOV, and Engr-Capt PYTOV expressed disagreement with ZIL'BERMAN's claim that note-taking prevented candidates from interpreting a lecture. They claimed that this was true only if, rather than selecting the main points of the lecture, the candidate attempted to take down every word. They also considered impractical his proposal that instructors should prepare notes or summaries for their courses, insisting that this would take too much time and that the notes would frequently have to be changed to keep abreast of technological advances.

Engr-Col GINTSBURG and Engr-Maj REZNIKOVSKIY proposed that training in the repair of radio technical equipment be divided into three periods: the first, for learning certain industrial skills needed in repair work; the second, for studying the principles of repairing radio technical equipment; and the third, for completing a series of practical exercises in repairing various types of equipment.

Engr-Lt Col KRASNYY denied that there were any deficiencies or gaps in maintenance and repair courses. He asserted that some of the methods of instruction to which ZIL'BERMAN referred in his article had been revised long ago.

Pioneer in Soviet Rocket Engineering--by K. I. BELYY (Page 41)

Abstract:

Reviews briefly the life and work of Fridrikh Arturovich TSANDER (1887-1933), one of the first Soviet rocket engineers.

The Use of Charactrons and Typotrons in the Sage System--by Sr Lt V. M. TUPITSYN (Pages 42-45)

Abstract:

Based on foreign press material, describes the characteristics and functions of special electron beam tubes used in the US antiaircraft defense system SAGE. Sources given include Ziviler Luftschutz No 3, 1959, and Electronics No 16, 1959. Illustrations accompanying the article include a schematic drawing showing how the system operates, a photo of the matrix used in a type C19K charactron, a data card for a target on the tube's screen, two drawings of targets on the screen of a charactron, and a schematic drawing of an apparatus for photographic projection of information.

Equipment and Its Maintenance

The Organization and Work of Technical Study Groups--by Engr-Lt Col I. P. ALEKSANDROV (Pages 46-49)

Abstract:

Discusses the role of technical study groups in increasing the theoretical knowledge and developing the practical skills of servicemen. He explains that these study groups are usually directed by an engineer, who is assisted by one of the better trained technicians in the podrazdeleniye. Members of the group include the podrazdeleniye commander and members of the party and Komsomol organizations. Study groups conduct activities during the entire training year and study a wide variety of technical subjects.

Toward a Highly Productive Work Group--by Maj M. N. MAKAROV (Pages 48-49)

Abstract:

Tells of a drive for greater efficiency and productivity in a technical operations chast' commanded by Engr-Sr Lt FEDOTOV. Other officers mentioned in the article are Capt Tech Serv KOT'YE, secretary of the party organization; Tech Sr Lt GUKOV, and Officers NIDERMAN and ZAYKIN.

Gas Analyzer-Warning Component "GS-SO" --by Lt Col G. K. MEZ'KO and Engr-Lt Col N. P. SUPRYAGA (Pages 50-53)

Abstract:

Explains the construction and operation of a gas analyzer and warning component used at electric power plants to determine the amount of carbon monoxide in the air. The device is equipped with a signal system to warn workers if the concentration of carbon monoxide in the air should reach a dangerous level. Schematic drawings of its gas and electrical systems accompany the article.

Control Panel for Loudspeaker Communications System--by Engr-Maj V. F. BUDZINSKIY and Engr-Capt V. K. KUTSIYAN (Pages 54-58)

Abstract:

Explains the operation of a central control panel for a loudspeaker communications system connecting as many as twenty separate work areas. Circuit diagrams accompany the article.

Short-wave Coaxial Cable Feeder Lines--by Engr-Capt A. V. KHOLICHEV (Pages 59-62)

Abstract:

Discusses the use of coaxial cables to transmit high-frequency energy from radio transmitters to antennas. He explains the physical processes which occur in single- and double-cable feeder lines and the effects which these processes produce.

New Method of Determining Angle Coordinates -- by Engr-Maj A. I. KORNIYENKO (Pages 63-67)

Abstract:

Based on foreign press material, discusses the monopulse method of tracking and guiding rockets, with specific reference to the AN/FPS-16 radar station developed by RCA. Sources given are Radio and TV News No 3, 1958; Electronics, April 1960; and Introduction to Monopulse, 1959.

News of Foreign Technological Developments

New Control System "Helilift" (Page 67)

Summary:

According to the Swiss aviation journal Interavia, the US has developed a fire control system (AN/TSQ) for Nike and Hawk batteries which may be transported in a helicopter.

Inertial Cuidance System for X-15 (Page 67)

Summary:

According to the journal Missiles and Rockets, the US has developed an inertial guidance system for the experimental X-15 aircraft.

Antiradar Rocket (Page 67)

Summary:

According to Aviation Week, the US is developing an antiradar air-to-ground rocket, named the Shrike, which is designed to destroy targets emitting electromagnetic waves.

Wear Indicator for Airplane Tires (Page 67)

Text:

According to the journal Interavia Air Letter, the Goodyear Company has recommended using a layer of red fabric in the casings of airplane tires to warn of excessive wear. Tests showed that such a layer did not affect the durability of the casing.

Antirocket Defense

Anticosmic Defense--by Engr-Col V. N. ANYUTIN and Engr-Col Ya. I. FAYENOV (Pages 68-71)

Abstract:

Allegedly based on foreign press material, reviews United States defense systems for detecting and tracking earth satellites or other space objects. It discusses the characteristics and capabilities of the SPASUR and Doplos radar systems and the Air Force radar complex on the island of Trinidad. It gives a brief description of a visual observation system utilizing special telescopes and television cameras which is being developed by General Electric. Sources given are Aviation Week, January-March, October 1961; Ordnance, March 1961; Science, March 1961; Electronics, November, December 1961; Flight, January 1961.

In the World of Science and Technology

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Organic Semiconductors and Their Prospective Use -- by V. S. MARKIN, Engineer (Pages 72-75)

Text:

Military technology makes havey demands on radio electronic devices. Radio technical systems must be reliable, durable, efficient, economic, compact and lightweight. It is difficult to meet these requirements with ordinary electron tubes. Only through the use of semiconductors was it possible to make a big step forward in this direction.

Although there are already in existence highly efficient semiconductor devices, science and technology are not satisfied with what has been accomplished. Research and development continues. Work is being done in two general areas: construction of new devices on the basis of known, existing materials and the search for new semiconductor substances suitable for technical use.

Both of these are areas of great importance. However, let us consider the latter. Despite the abundance and variety of semiconductor devices, very few substances are used in their construction. Of these the best known are silicon and germanium. However, rapidly expanding technology creates new demands which materials presently being used cannot always satisfy. Consequently, it is necessary to search for new materials.

At present inorganic substances are used in semi-conductor devices. These substances - water, earth, air, stone, and many others - make up the inanimate world around us. The majority of inorganic substances are relatively simple in composition. But there are other substances in nature, mainly in the form of various carbon compounds, which are called organic. These substances are found in the composition of plants, animals and, finally, man himself.

Inorganic substances in nature number almost 50 thousand, but there are already known to be over a million organic substances. Although both classes consist of the same elements, there is a great difference in their quantity. This is explained, first of all, by the fact that molecules of organic substances consist of very large numbers of atoms and, secondly, by the fact that much depends on which atoms make up the molecule and how these atoms are arranged in it. Just as many completely different buildings are built with the same bricks - homes and factory buildings, clubs and garages - a large number of different substances are comprised of a comparatively small variety of atoms.

Moreover, they may be synthesized to create substances which do not exist in nature. The possibilities of organic chemistry in this respect are virtually unlimited! Especially important is the fact that substances of this class have been found to possess the properties of semiconductors!

In fact, a simple appraisal of the vast quantity of substances which specialists have at their disposal shows the many possibilities open to them. At present, an engineer engaged in the construction of semiconductor devices has a very limited selection of materials from which to choose. Furthermore, the substances do not always have the desired characteristics. What is there to do? One is obliged to use that which exists, sometimes having to choose the least of several evils.

The selection is being widened by the discovery of new materials and when the synthesis of these substances with predetermined properties is possible, it will become almost unlimited. A scientist constructing new devices will no longer have to consider whether materials with the necessary properties are available; he will not be kept from bold and original decisions simply because needed materials do not exist in nature. From the very beginning the constructor will determine the best characteristics for the material and then select or synthesize the needed materials. Obviously, many outstanding devices may be developed under such conditions.

Where will organic semiconductors be used? It appears that they could be used in almost any area where inorganic semiconductors are now being used. And, because of the wide diversity of their properties, they will in many cases surpass their "inorganic brothers."

One of the most important electrical characteristics of a substance is its conductivity. The degree of conductivity depends on 2 factors: first, the concentration of free carriers, i.e. The number of free electrons in a unit of the substance, and, second, the ease with which they move, i.e. their drift mobility. Organic substances possess diverse combinations of these factors and, hence, various degrees of conductivity. They cover a wide area, ranging from the best insulators which have a conductivity less than 10^{-22} ohm^{-1} cm^{-1}, to 50X1-HUM metals with a conductivity of 10^4 ohm^{-1} cm^{-1}.

Organic semiconductors may have very great or very small dielectric constants. They may be diamagnetic, nonmagnetic, or paramagnetic, semifluid or solid, amorphous or single crystal, very soft or extremely hard.

Through their use it will probably be possible to develop solid batteries and solid electrolytes, elements / for ferroelectric devices and memory systems for computer machines. They may also be used for the storage of energy, in the manufacture of cold cathodes, in electronic printing, and in many other areas. I will cite some examples.

Some compounds which under ordinary conditions are transparent become opaque under ultraviolet rays. This property could be used in the manufacture of electronic shutters having no moving parts. This might be accomplished in the following manner. A small plate will be placed in front of, or perhaps inside of, the camera. If the plate is continuously exposed to ultraviolet rays, it will be opaque; hence light will not enter the camera. The shutter is closed. Cut off these rays for an instant and the plate becomes transparent. The shutter is open. Light enters the camera and comes in contact with the film. The photograph is made.

There are also possible variations of this system. If, for example, one of the objective lenses were made of this substance, the objective could serve also as a shutter. An important problem is the conversion of light and heat energy into electricity. This work is performed by photocells or solar batteries and thermopiles. Solar batteries are already being used in earth satellites to convert sunlight into energy for all the ships electrical apparatus. These are usually made of silicon; however, this is very complicated and expensive. Organic semiconductors may make further progress in this area possible. In any case, the first experiments in this direction have been successful.

Thermogenerators are also now in existence. Their principle of operation is as follows: if a closed electrical circuit is constructed from 2 different materials, for example, 2 different metals (or better, semiconductors), and if one of the junctions between these materials is heated and the other is cooled, an electric current is produced in the cell. An apparatus of this type is called a thermocouple. A combination of these thermocouples constitutes a thermopile, capable of producing a current of considerable strength. Some of the first thermopiles were used by Soviet partisans during the great patriotic war to supply power for radio stations. Their thermopiles were assembled in the bottom of an ordinary mess tin. The lower junctions of the thermocouples were heated by a small fire and the upper junctions were cooled by water poured into the tin. The pile produced sufficient current to supply a transmitter. Subsequent thermogenerators have been considerably improved.

Nevertheless there are some difficulties involved in the selection of materials for thermopiles. The problem is that these materials must possess the following properties: high electric conductivity in order to reduce the loss of the electrical energy within the thermopile itself; high thermoelectric coefficients, positive and negative, in order to effectively convert heat into electricity; minimum thermoconductivity, so that heat does not pass through the material of the thermocouple from the hot junction to the cold. In other words, a rather complex combination of properties is required. Inorganic semiconductors currently being used do not fully satisfy these requirements. The potentialities of organic semiconductors in this area appeared to be much greater. Some of them have high electric conductivity, high thermoelectric coefficients and low thermal conductivity. It is entirely probable that materials will be found which have all of these properties in common, i.e, in the right combinations.

Thermopiles can also perform the reverse function of converting electricity into heat and cold. If an electric current is passed through a thermopile, some of its junctions are heated and others are cooled. A thermopile does not convert electricity into heat in the same matter that a hot plate does. In thermopiles electricity is only partially transformed into heat. The principle work consists of transferring heat from a cold junction to a hot one. Of course, the expenditure of energy in this is not great. If the direction of the current is changed, the hot junction begins to cool and the cold begins to heat. It is on this principle that semiconductor refrigerators are designed. The use of organic semiconductors in this area is expected to meet with considerable success.

If one uses his imagination, it is possible to conceive of materials for solar batteries and thermopiles enhanced by still another property - elasticity. From such materials it would be possible to make a number of useful fabrics. From these fabrics, capable of converting light into electricity, it would be possible to sew, for example, a tent. By pitching such a tent in an open area, it would be possible to obtain from it electricty for radio receivers, transmitters, and other needs. This would eliminate the necessity of taking along dry batteries and other equipment.

One can also conceive of a "refrigerator" fabric capable of converting electricity into heat and cold and vice versa. For example, why not use it in making protective coveralls? They might not be very attractive or elegant, but they wouldn't be bad. With a small flashlight battery in one of the pockets, it would be possible, simply be throwing a switch, to warm oneself at the expense of the surrounding cold. If the temperature were very high, one would need only to flip the switch and the coveralls would soon become cool as a refrigerator. There are many representatives of various professions who would like to have such coveralls.

It may be said that this is simply a fantasy. Yes, at present it is a fantasy. But it is by no means impossible. We are already accustomed to a high tempo of scientific progress in which the most fantastic ideas sometimes become yesterday's science.

Organic semiconductors may also be luminophors, i.e., they may

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luminescent properties under certain conditions. It is possible that some materials may have select electro-, phono-, actino-, magneto-, thermo-luminescent properties.

In the past most discussion concerned the physical application of organic semiconductors. But they also have applications in chemistry. Take, for example, the distillation of sea water. This labor-consuming but important process might conceivably be made easier by using a semicnnductor ion-exchanging resins. Placed in sea water, they would draw out of it the dissolved salt. In the same manner, they might be used to purify various chemical liquids.

Organic semiconductors may also play an important role in catalysis. They will make it possible to conduct complex chemical reactions at ordinary temperatures and pressures. Electrodes which remain inert and stable at high temperatures are needed to bring about certain electrochemical reactions. The possibility of using certain carbon polymers for this purpose has already been demonstrated under laboratory conditions.

The problem of making various devices on the basis of organic semiconductorsmaterials is, of course, important. However, the most important result of studying these substances is, without doubt, a better understanding of the biological processes which take place within a living organism. The fact is that, in the opinion of scientists, organic semiconductors play an all-important role in such life processes as vision, photosynthesis, the transfer of energy within an organ, and even in the spread of cancer. Knowledge of these phenomena would in itself be the greatest victory of the human mind. It would then be possible to attempt to reproduce them artificially under laboratory conditions. Success in these attempts would promise many benefits.

Consider, for example, the muscle of an animal. It is a highly developed mechanism, transfering the chemical energy of food directly into mechanical energy. It is an exceptionally compact, sensitive, efficient, dependable mechanism. Here one can learn much from nature. Is it not tempting to try to create an artificial model of a muscle?

And photosysthesis? This process makes it possible for animals and man to exist on earth. From water, carbon dioxide gas, and mineral salts, green plants, under the influence of sunlight, produce supplies of food for all living creatures. This process produces oxygen, necessary for respiration. If it were not for photosynthesis, there would be no animals or humans, at least, not such as exist today.

Man has accomplished much. His victories over nature have been great. But in the matter of creating food supplies he is still largely dependent on the caprices of weather, crops, etc. And nature does not always indulge man. This is why generations of scientists have been dreaming of artificially reproducing photosynthesis, thereby breaking man's dependence on nature. This is an extremely important but complicated problem. It has not been solved, but scientists continue to work on it. It may be that the study of organic semiconductors will play a leading role in its solution.

We have mentioned only a few of the potentialities of organic semiconductors. They are indeed vast. However, it should not be assumed that these semiconductors must supplant their "inorganic brothers." Not at all. The 2 classes are not antipodes, but friends and allies, designed to help each other. Well designed inorganic semiconductors will also dependably serve mankind. Of course, a large part of that which has been discussed here belongs to the future, perhaps even the distant future. The science of organic semiconductors is still in its early stages, but it is developing before our very eyes.

In conjunction with a whole series of disciplines - physics, chemistry, biology - this science is rapidly moving forward. There is still much which is difficult, complex, and vague. Nevertheless, scientists of all countries are assiduously working in this area of knowledge. Semiconductors are a very promising branch of science. Their significance and technology is growing with each passing day. It is no coincidence that in the Program of the Communist Party it is stated that in the future "radioelectronics, semiconductors, and ultrasonics will occupy an even more important place in industrial technology."

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From the History of PVO Troops

Courage and Heroism -- by Maj (Res) S. N. KIRICHENKO and Col V. P. IL'IN (pages 76-77)

Abstract:

Praises the heroic feats of Soviet airmen during early days of World War II.

Criticism and Bibliography

Electron beam Storage Tubes -- by Lt Col M. G. NIKOLAYEV (Pages 78-79)

Reviews the brochure Elektronno-lachevyye trubki s na kopleniyem zaryadov(Electron beam Storage Tubes) Voyenizdat, 1961) by N. P. SUPRYAGA. According to the review, the brochure is based on foreign press material and examines the construction, mode of operation, and use of electron-beam storage tubes used in radar sets and electronic computer machines.

Book on Problems of Contemporary Physics -- by Lt Col A. I. MOTYL'KOV (Pages 79-80)

Abstract:

Reviews the book Neizbezhnost' strannogo mira (The Inevitability of a Strange World Molodaya Gvardiya, 1961), by D. DANIN. The book reportedly "explains the contemporary physics without a single mathematical formula," and is recommended for servicemen interested in the growth of science and technology.