Space INTELLIGENCE NOTES

SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

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SERGEI VARENTSOV MAY BE NEW SOVIET ROCKET CHIEF. Announcements for recently held Artillery Day celebrations in Moscow listed the main speaker as "chief marshal of artillery Sergei Varentsov, commander of rocket forces and artillery." All previous announcements listed the commander as Marshal Kirill Semenovich Moskalenko (as reported in SIN, Vol 2, No. 1, p. 25). Moskalenko was appointed on October 26, 1960, following the death of Marshal Mitrofan Nedelin in an airplane crash. (Source: Washington Star, November 19, 1961)

THEORY ON 'TUNGUS WONDER' PROPOUNDED. A Russian scientist, K. Florensky, Chief of a Soviet expedition that studied the scene of a big explosion near the Hunguska River in Siberia on June 30, 1908, now believes the cause of the explosion to be a comet's head and not a meteorite or interplanetary atomic weapon as previously theorized by a number of Russian scientists. The blast was one of the most spectacular natural phenomena in modern history. It killed 1,500 reindeer, felled trees over an area of 700 square miles, and stamped its record on the charts of distant seismographs.

K. Florensky reported his findings in the Communist youth newspaper KOMSOMOL PRAVDA. He denied at the outset that the "Tungus Wonder" was really an atomic weapon fired from some other planet.

"Not true," Florensky wrote.

A thorough inspection of the cratered region, he said, proved all talk about increased radioactivity there is unfounded. The radiation is no greater than elsewhere.

Standard reference works long have attributed the Tungus blast to an enormous meteorite.

There is a close relation between the paths described by meteor showers and the orbits of comets, which consist mainly of frozen gases.

Florensky expressed belief that if the tungus wonder had been a meteorite, there would have been metal and indications of prolonged heat in the explosion area. These were not found, he said.

But the frozen gases in the head of a comet, he reasoned, would have melted under friction as it plunged into the atmosphere and set off the tremendous blast near the earth. (Source: Baltimore Sun, November 27, 1961)

RUSSIANS CONTINUE OPPOSITION TO UN SPACE ACTIVITIES. The Soviet Union ended its long boycott of the United Nations' Committee on the Peaceful Uses of Outer Space by attending a meeting held last November in New York.

However, Soviet Deputy Foreign Minister Valerian A. Zorin stated at the meeting: "Our position is the same.", and "We consider that it's (United Nations' Space Committee) quite useless."

Anyhow, he added, the committee's term of office is about to run out, since it was set up for 1960 and 1961 only.

The meeting, to enable the Committee to report to the General Assembly, was called by request of the United States and other Western powers over Zorin's objections that essential Soviet-U. S. agreement on details was lacking.

The Assembly created the committee on the peaceful uses of outer space with a membership of 18 countries in 1958 and, in an unsuccessful bid to win Soviet cooperation, expanded it to 24 in 1959.

The 18-nation committee met in May and June 1959 without the Soviet Union, Czechoslovakia, Poland, India, and the United Arab Republic, and submitted recommendations.

The 24-nation committee, charged with planning an international space conference, never has met.

In a letter to U Thant Nov. 14, Zorin objected that the United States had turned down a Soviet proposal that the committee membership be divided equally among "all three groups of states" - evidently meaning the Communist, neutralist, and Western-Allied - and had pushed a Western candidate against neutralist candidates for chairman.

The United States is trying to dominate the committee, he declared, and the Soviet Union "cannot acquiesce in such unequal conditions."

The committee consists of Albania, Argentina, Australia, Austria, Belgium, Brazil, Britain, Bulgaria, Canada, Czechoslovakia, France, Hungary, India, Iran, Italy, Japan, Lebanon, Mexico, Poland, Romania, the Soviet Union, Sweden, the United Arab Republic, and the United States. (Source: Washington Post, November 26, 1961)

VOSTOK 1 DESIGN EXTRAPOLATED. Using the scant official Soviet data on the Vostok 1 flight of last April 12, which made Major Yuri A. Gagarin the first man to go into orbit, scientists at Bendix Corporation's Research Laboratories Division conducted a computer analysis of most of the basic aspects of Gagarin's vehicle.

Fig. 1 illustrates the Vostok 1 design revealed by their analysis. This probable configuration of spacecraft and astronaut reentry capsule shows Gagarin and capsule mounted in a prone position within the spacecraft.

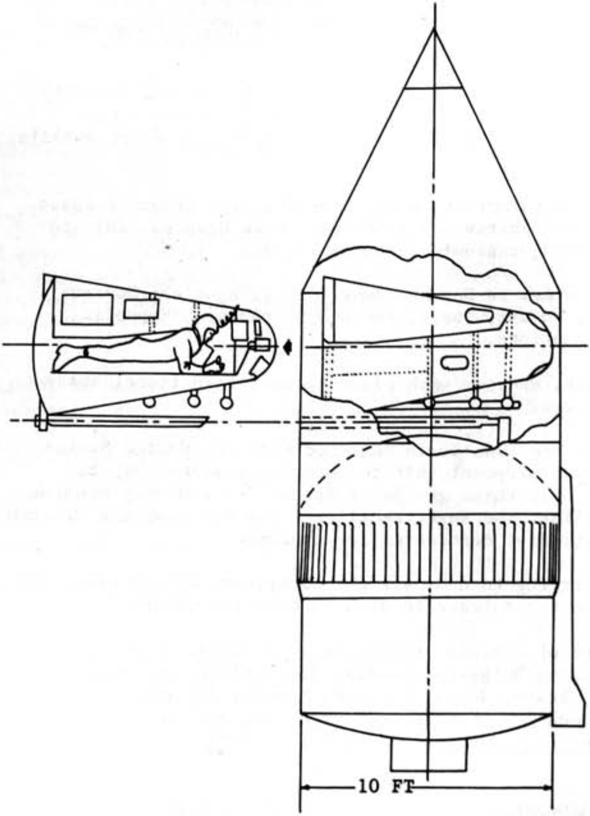

FIG. 1. Possible Configuration of Vostok 1

It was concluded from the study that the capsule was ejected at the recovery altitude of 23,000 ft after an arbitrarily assumed atmospheric reentry altitude of 60 miles. The peak deceleration values found indicated that the astronaut was oriented in an optimum manner to withstand the reentry g-forces (with the g-forces presented to him from chest to back).

On the basis of derived heating profiles, the scientists concluded that little internal cooling was used since most of the reentry heating effects were probably absorbed by an ablative shield and the shock wave of a blunt-nosed reentry vehicle.

Reentry trajectories for both lift and nonlift vehicles were considered. It was concluded that the Vostok 1 did not have lift because, in most cases, lift resulted in an excessive reentry angle if the end conditions were to be satisfied. The conclusion that the spacecraft did not have lift was also supported by the Soviet timetable for space flight which includes Moon missions in which lift cannot be used for lunar descent orbit.

The assumption that a parachute recovery was made after ejection of capsule has since been confirmed by official Soviet information. The most important parameters derived in this analysis included calculation of the original orbit, de-orbit phase, and atmospheric reentry phase. Data on orbital braking, retro-thrust system, launch system, impact accuracy, vehicle configuration, orbital orientation, peak reentry decelerations, reentry heating profiles, and recovery system were also derived or extrapolated from the complete analysis. (Source: Space/Aeronautics, Vol. 36, No. 6, Part 1, p. 54)

US SPACE BRAIN POWER POTENTIAL FALLS OFF. During the past six years, the number of students majoring in engineering subjects in West Germany have almost doubled. In the United States, by contrast, the number of freshmen entering engineering schools has dropped for the fourth consecutive year.

According to a recent report of the German Academic Exchange Service (Deutscher Akademischer Austanschdienst), the total number of such students in Germany studying at technical universities and engineering schools has risen from 58,683 in 1954/55 academic year to 101,598 in the academic year just completed (1960/61).

Based on a survey of 186 U.S. engineering schools, representing 89% of the freshman engineering class, first-year enrollment in engineering decreased 2.3% in 1961.

This is considered significant because only 37,800 engineers were graduated in the United States in 1960. A decade earlier, the nation graduated 52,700.

The Engineering Manpower Commission of the Engineers Joint Council expects a U.S. skid to 32,000 by 1965 despite prophesies of a vastly increased need due mainly to the booming new space business. (Source: German Science Bulletin, No. 68, November 1961 and Missiles and Rockets, December 11, 1961)

MAN'S FIRST 24 HOURS IN SPACE. The following report on Major Gherman Titov's historic orbital spaceflight of last August was adapted from an article appearing in PRAVDA entitled "Hours of the Historic Flight" and written by A. Trifonov of the Soviet Union:

FIG. 2. Major Gherman Titov

The days at the cosmodrome when preparations of the Vostok-2 rocket were in full swing are unforgettable.

The headquarters and command post of the historic flight were situated at the cosmodrome. All control links affecting numerous services, and supporting the preparations and launching, crossed in the hands of the Chief Designer, Chief Technician of all launching preparations, and the State Commission.

Another center, the co-ordinating computer center, whose activity was also directed from the command post, was functioning hundreds of miles away. It is the work of this center during the historic 25 hr. from the morning of the 6th to the morning of the 7th of August that is the subject of this article.

The morning of the historic day of 6 August set in. Signals of the start and exact launching time were passed on to all tracking stations and computer centers.

The initial information on telemetric readings, bearing witness to the normal operation of the engines, controls and other systems in all stages of the carrier-rocket and the injection of Vostok-2 into orbit, began arriving at the co-ordinating computer center.

The first important moment had arrived. What were the period of rotation, apogee and perigee of the orbit? Did they differ from the calculated figures? Would it be necessary to rectify the flight program? Work proceeded at all computer centers at top speed and under utmost tension. In the meantime the cosmonaut, Major Gherman Titov, relayed his reports: "Everything is going fine. Everything on board the ship is in order. I feel very well. Tell me the orbit parameters."

The spaceship disappeared from the territory of the Soviet Union. Contact with the cosmonaut was now maintained through powerful short-wave radio centers. Once again, this time to the world, the spaceman reported: "Everything on board the ship is in order. I feel very well."

Control data from T.V. stations began to arrive at the command post at the cosmodrome and at the co-ordinating computer center.

The initial processing of orbital information ended. The exact orbit parameters were obtained. It was established that the deviations from the calculated figures were slight. This was very important. The information had to be passed on to the cosmonaut at once. He had to check the time with the Earth and alter his navigating system in accordance with the more exact data. He had to know his true position precisely It was not precluded that, depending on the way the cosmonaut felt, a landing would have to be made at a time unforeseen by the program.

Time-checks and correction of navigational instruments were to be carried out throughout the whole flight, but the first checks were of particular importance.

The second orbit began. According to the information from the co-ordinating computer center, the following information was relayed in succession to several radio stations: "Orbit, normal; period of rotation, 88·6; apogee, 257 km.; perigee, 178 km. Here are the corrections."

The cosmonaut knew exactly now where he was and started working in conformity with the flight assignment. He checked the spacecraft's manual controls, conducted observations, recorded information in the ship's log and simultaneously on the ship's compact tape-recorder.

Everything finally fell into proper routine at the beginning of the third orbit. Work on board the ship proceeded according to plan. Communications were maintained by short-wave and ultra-short-wave radio, the ship's systems checked, navigational instruments checked and rectified, body functions checked and reported, and meals taken. But just the same, the cosmonaut, command post, and co-ordinating computer center, kept a sharp vigil.

Instructions came from the command post at the cosmodrome to make additional calculations, obtain more exact information of the orbit, and prepare data for the information service.

The chief technician of the flight, now staying at the command post at the cosmodrome, personally often established contact with the cosmonaut. In such cases the experts at the co-ordinating computer center followed each order passed on by the chief technician to the cosmonaut so as to lose no time in starting work on instructions for the co-ordinating computer center.

Meanwhile, everything was in order within Vostok-2. Observations were being made, and the flight assignment carried out exactly according to schedule. The cosmonaut had his first dinner and supper in outer space and was getting ready to sleep. At the cosmodrome and co-ordinating computer center, however, tension remained as high as ever. The specialists attentively analyzed telemetric data coming in on the functioning of all the ship's systems and on the conditions inside the capsule. The doctors analyzed objective information relayed to the Earth on the state of the cosmonaut. They checked up on the way this information tallied with the cosmonaut's reports. More exact calculations were drawn up for possible contingencies unforeseen by the flight program. The cosmonaut was given the right and possibility to land his craft during any orbit using either manual or automatic controls.

All information received from the cosmonaut and tape-recorder were again checked and compared. The entire country followed the unprecedented flight with apprehension. One can imagine the tension at the center receiving initial data from space. The expressions on the faces of the people there changed from one of deep concentrated thought to a beaming smile, sometimes followed by an elated cry. Deep sighs of relief burst out at times among the seated men and women, who after several minutes of tense waiting received exactly the information which had to agree with preliminary calculations.

At 18:00 hr., the cosmonaut reported: "You may do what you like, but I'm going to sleep."

The cosmonaut rested, but there was no rest for the people at the cosmodrome. There was also no break for the co-ordinating computer center service. Other specialists went on duty, again checked up the orbit and descent calculations, and prepared new signals to be passed on to the spacecraft.

Strict control was established throughout the entire network of measurement, communication and tracking. Nothing except the most urgent need was to disturb the cosmonaut's sleep, but checks of his condition were not to be interrupted for a second.

The cosmonaut's pulse was 54-56 and his breathing even and measured.

The time approached for the cosmonaut to wake up. Contact had to be made with him. Would he wake up himself or would it have to be done from the Earth? There was some delay in his awakening. Was he all right? After all, he was the first ever to fall asleep in space.

At 2:37 hr. Moscow time the cosmonaut became awake. He indicated that he slept well and felt good. After reporting about conditions in the cabin and the work of the basic equipment of the ship the cosmonaut continued to fulfill the flight program.

The fourteenth, and the fifteenth orbits were completed. Now, besides observing how the cosmonaut felt, the preservation of conditions of vital activity in the ship's cabin, and further ensuring of two-way communication with the cosmonaut, the tasks of primary importance became: to control the system of the ship's orientation, to prepare the braking engine installation for work and to ensure the descent of the ship, in case of necessity, by manual control.

The time came for all tracking, search, and if need be, rescue services to be activated, and last preparations were made at all the ship, aircraft and helicopter centers.

Signals were constantly given to the spacecraft to switch the television sets on and off, and to relay to the Earth tape recorded information from aboard the ship. The time and navigation system were checked once again. According to the telemetry, and on the basis of the cosmonaut's reports, the system of orientation was in perfect order; the operation of the navigation and manual landing systems was verified and ready for use.

Gherman Stepanovich reported to the chief technician about his impressions and made the final entries in the ship's log book and on a tape-recorder.

Then came the sixteenth orbit. The chief technician asked the cosmonaut whether he was ready for landing. He replied that everything was ready for the descent, the equipment was checked, the flight program fulfilled, and he was ready to land.

At 9:30 hr., 7 August, the spaceflight was nearing completion. It was now a matter of seconds before the automatic devices were switched on to ensure the braking and gradual descent of the ship.

Tension reached a climax. The leading specialists were now in the offices where the calculations were being made and which now had most of the information on operative communication. This was a huge hall in the midst of which stood tables with large maps. Next to the telephones connecting the co-ordinating center with the command post at the cosmodrome, centers and computing stations, were operators and engineers of the center. All of them were at their stations and all of them eagerly awaited how the system of orientation, the braking engine instalation and automatic devices would operate.

Everything was ready for landing both by manual or automatic control of the ship. Everything was ready, in case of necessity (for example in case of delay) to descend also on subsequent turns.

What will it be like? One minute, another minute, now it was a matter of seconds. Time: the signal could be given!

And so the first reports came from the computing center: "The signal for landing was given." Immediately after followed the confident voice of Gherman Titov: "The signal for landing was received."

After a little time another report came: "The braking engine was switched on, it worked strictly to time, and was switched off. The descent began."

The Signal transmitter installed in the ship, operated with great precision: "All is in order, all is well."

At 10:04 hr., the signals from the spacecraft were interrupted. The signals were absent but everybody gave a sigh of relief. They disappeared at the designated time. This meant that the ship had entered the dense layers of the atmosphere. At that moment everyone imagined the following picture: cutting the atmosphere the ship, with its heat shield aglow from the clash with the air, was rushing to the Earth like a whirlwind of fire. From all over the country the observation stations reported: "The spaceship Vostok-2 has entered the dense layers of the atmosphere."

Now everybody was tense and continued to listen; very soon another transmitter had to start functioning, the one operating at a low height installed on the ship and on the cosmonaut's seat. Then came the signals, different from the others, which confirmed: "Everything is in order. The ship and the cosmonaut are landing."

Dozens of tracking centers began to follow the movement of the ship and the cosmonaut. They constantly recorded the descent path. Tracking results were immediately transmitted to the cosmodrome and to the co-ordinating and computing center.

Then came the last, final stage of the protracted flight. The planes and helicopters were on the runway ready for the search operation. The ship and the cosmonaut were still in the air but it was already known where they would land. The co-ordinating and computing center reported this to the chief technician of the flight and transmitted the expected co-ordinates of the landing to the tracking stations. The aircraft and helicopters took off.

Calculations continued and they confirmed that the descent was proceeding normally. The landing would take place in the prescribed area not far from the calculated point of landing near the place where the space ship Vostok-1 landed with Major Yuri Gagarin.

The tracking, search and recovery services went into action. The group of specialists defining the point of landing formed a ring around the special maps using devices for speedily pinpointing the exact spot. What about this spot? Will it be convenient for the cosmonaut to land?

Although everything was calculated and everything foreseen for any eventuality - for landing on water and in unpopulated places - and the cosmonaut had everything necessary for this, means of recovery had to be brought to the landing point in order to help Gherman Titov in every way after the long spaceflight he had undertaken for the first time.

The cosmonaut landed. Now he had to be met as quickly as possible and brought to the search center or some inhabited area.

The first information came from witnesses of the cosmonaut's landing. But now this was not enough. Exact information had to be received from the specialists who met and "touched" the hero. Very soon Gherman Titov arrived at the district center from the place of landing. (Source: Spaceflight, Vol. IV, No. 1, January 1962)

PLANS FOR BIOCHEMICAL RESEARCH. According to Professor S. Mardashev of the Academy of Medical Sciences USSR, one of the key areas of Soviet research in biochemistry is the study of the structure and physical, chemical, and biological properties of biological polymers with high molecular weights, such as nucleic acids and proteins. Research in the biochemistry of metabolic processes on the molecular and cellular levels is considered important, since exact metabolic reactions must be determined if more effective antibiotics are to be found. Attention must also be given to the development and application of enzymes for medical diagnosis. Mardashev notes the necessity for interdisciplinary cooperation and recommends that biochemical institutes be expanded to include departments of physics and physical chemistry. For instance, the analysis of protein structure, which can most effectively be accomplished with the use of x-ray analysis and computers, will require the services of physicists and computer specialists. He also recommends that staffs of medical schools be expanded in order to release professors from classroom duties and enable them to engage in active research. (Source: Meditsinskiy rabotnik, November 17, 1961, 2, cols. 2-6)

ON THE MOVEMENT OF ARTIFICIAL LUNAR SATELLITES. Early in 1961, the Soviet publication ASTRONOMICHESKII ZHURNAL published an article concerning hypothetical lunar satellite orbits. The authors, V. A. Brumberg, S. N. Kirpichnikov, and G. A. Chebotarev, prefaced their article with the following Authors' Introduction:

"The paper studies four variants of a hypothetical lunar satellite orbit. The movement of the satellite is stable during a sufficiently large time interval. Basic results obtained from numerical integration are cited in detail in tables and graphs. The purpose of the paper is to study the movement of artificial lunar satellites using a number of particular examples. Orbits are calculated using the method of numerical integrations. This method permits us not only to compute the ephemeridies of the satellite, but also provides a good idea of the evolution of the orbits under study during a sufficiently large number of revolutions. From the mathematical point of view, the problem reduces to integrating the equations of motion for a point of infinitely small mass which is located in the lunar gravatational field and experiences perturbations caused by the nonspherical shape of the moon and the attraction of the earth and sun. The equations of motion, the coordinate system, and the initial conditions are analyzed in detail. The following four different types of orbits are studied: (1) a polar orbit with a small eccentricity; (2) an equatorial orbit with a small eccentricity; (3) a polar orbit with a large eccentricity; (4) an equatorial orbit with a large eccentricity." (Source: Physics Express, Vol. 4, No. 1, 1961, p. 32)

THE USE OF MIXTURES OF HYDROGEN AND NITROGEN FOR REMOVING DISSOLVED OXYGEN. Obtaining hydrogen and nitrogen gases which are totally free from dissolved oxygen has been and is still a perplexing problem for the chemist. Soviet chemist K. D. Omoarova, Institute of Chemical

Sciences of Kazakh SSR, in an article appearing in Zavodskaya Laboratoriya, describes the following technique as presently being used in Kazakh for obtaining pure gases:

"Nitrogen or hydrogen is usually passed through test solutions for removal of oxygen in the supporting electrolyte in electrochemical analytic practice. These gases, however, contain impurities which are rather difficult to remove. For preparation of an inert gas, we have adopted electrolysis of hydrazine salts. During reduction of hydrazine on the cathode, hydrogen is formed; during its oxidation on the anode, nitrogen is formed. The gases thus obtained are free from oxygen.

'Platinum plates 2.7 by 3.2 cm are used as electrodes. A saturated solution of hydrazine hydrochloride was used. The gases liberated were passed through a potassium iodide and starch solution to check for presence of chlorine. No liberation of chlorine was observed even when a current of 3 to 5 amperes was used." (Source: Industrial Laboratory, Vol. 27, No. 5, May 1961)

PRODUCTION OF HIGH-PURITY BERYLLIUM. High-purity beryllium has been produced on an industrial scale by the chlorination of BeO with CCl_4 and electrolysis of the $BeCl_2$ produced, mixed with NaCl, at 320 to 340°C. In laboratory-scale chlorination of BeO containing no more than 0.006% impurities, the optimum temperature was found to be 650 to 700°C and the optimum feed rate of CCl_4, 25 g/min. Nickel and nickel-base alloys were found to be the best materials for condensers operating in a $Cl-BeCl_2-CCl_4$ atmosphere at temperatures no higher than 300°C. The $BeCl_2$ produced contained 0.005 to 0.045% impurities and 0.01 to 0.1% water-insoluble residues. In the experimental industrial production of 25 tons of $BeCl_2$, the consumption of CCl_4 was 1.6 kg per kg of $BeCl_2$; the degree of $BeCl_2$ condensation was 97.8%; the direct extraction of $BeCl_2$ was 85%, and with reprocessing of wastes reached 96%. Initially, the electrolysis of the $BeCl_2$-NaCl mixture was accomplished with nickel cathodes; subsequently, graphite cathodes were used, with a cathodic current density of 6.5 to 7.5 a/dm^2. The purity of the electrolytic Be was 99.937 to 99.966%. This simple, comparatively safe, and economical method was employed in the production of several tons of Be pure enough for atomic industry applications. (Source: Atomnaya energiya, Vol. 11, No. 3, September 1961, p. 233-239)

FLASHLESS DIE FORGING. The Technological Scientific Research Institute of the Automobile Industry, in cooperation with the Moscow Automobile Plant imeni Likhachev, has developed a new method for die forging of gears with increased precision in which special dies are used and compensation pockets K_1 and K_2 replace the flash gutter (see Fig. 3). The compensation pockets insure hydrostatic compression during the forging

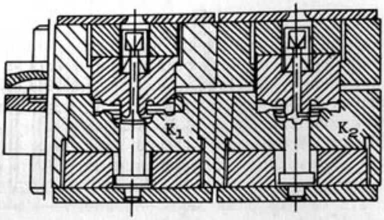

FIG. 3.

process and prevent breakdowns in the crank press in case oversized blanks are used. The illustration shows a die used for forging gears with a central hole more than 50 mm in diameter in three operations: upsetting and edging the blank (I), fullering (II), and finish-forging (III) in which the metal excess is pressed into the compensation pockets. (Source: Avtomobil'naya promyshlennost', No. 11, November 1961, p. 35-41)

A NEW ULTRASONIC METHOD FOR MEASURING THE ELASTIC PROPERTIES OF SOLID BODIES AT HIGH TEMPERATURES. Russian scientists A. A. Kalugin and I. G. Mikhailov have, within the past year, proposed an ultrasonic pulse method for measuring the elastic constants of material (Young's modulus, the shear modulus, and the Poisson coefficient) at high temperatures.

In many practical cases, it is necessary to know the values of the elasticity moduli of materials at high temperatures, particularly materials used in components operated under vibration conditions. The more commonly used static methods of testing materials not only produce results of low accuracy, but the magnitude of the static elasticity modulus is always, to some degree, subject to the effect of relaxation phenomena: creep and after-effect. Values of the elastic constants determined by the static methods depend on the duration of testing and the nature of the loading, and this has an especially great significance at high temperatures. Moreover, the process involved in measuring the elasticity moduli by the static method is cumbersome.

Recently, dynamic methods of testing materials have become widely used. These methods are free from the inherent shortcomings of static test methods. Included in these new techniques for testing are resonant or

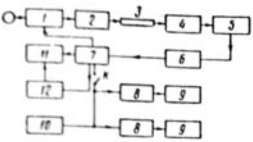

FIG. 4. Installation Block Diagram

(Source: Electronics Express, Vol. 3, No. 10, 1961, pp 25-26)

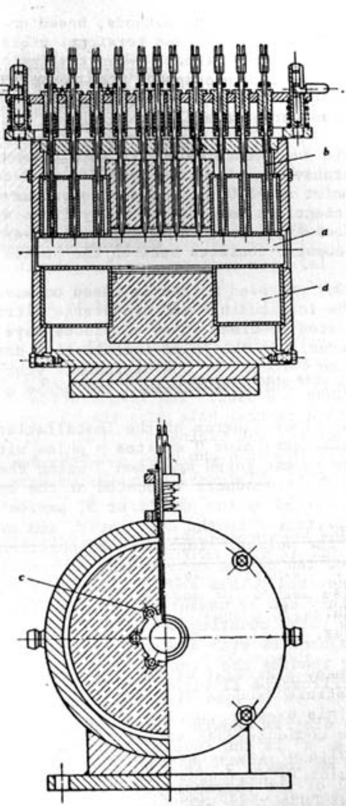

FIG. 5. Heating Unit Diagram

radio-engineering methods, based on measuring the proper frequencies of the longitudinal and torsional vibrations of the specimen, and ultrasonic pulse methods. When testing by these techniques, the elastic constants are computed from measured values of the proper vibration frequencies or from the propogation velocities of longitudinal and transverse waves.

The fundamental elements in ultrasonic transducers of longitudinal and transverse vibrations are X- and Y-cut quartz plates having a Curie point of ~500°. In order to circumvent this difficulty, the Russian scientists make use of delay lines with cooling of the transducers. However, even this arrangement gives rise to difficulties in producing acoustic contacts between the heated specimen and delay line.

"Our proposed method is based on measuring the propogation velocities of the longitudinal and transverse ultrasonic waves in a nonuniformly heated specimen whose end-faces have been cooled to admissible temperatures. In the pulse installation designed for this purpose, the propogation velocity of the ultrasonic vibrations is measured according to the cyclic method----using a two-probe scheme.

"The block diagram of the installation is shown in Fig. 4. The ultrasonic pulse generator Q excites a pulse with a carrier frequency of 2.5 Mc in the investigated specimen 3 using the transducer 2. The signal received by the transducer 4 located at the opposite end of the specimen is amplified by the amplifier 5, passes through the detector 6 and the amplifier 7 to the oscillator, and synchronizes the repetition frequency of the pulses. Thus, the propogation velocity of the vibrations in the specimen can be measured by determining the repetition frequency of the generated pulses and the length of the specimen. The repetition frequency can be measured with a sufficiently high degree of accuracy by the pulse counting method. The installation uses binary counters 8 in conjunction with a mechanical counter 9. A quartz oscillator 10 is used for reading the time interval. The unit also includes an electronic oscilloscope 11 with a sweep generator 12.

"The diagram showing the principle of the heating unit is shown in Fig. 5. Here "a" is the investigated specimen which is 20 mm in diameter and 160 mm long; "b" is a band of 11 platinum-platinum-rhodium thermocouples (all of the thermocouples are subjected to identical conditions and are calibrated with the same instrument); "c" is the heating element that is 60 mm long; and "d" consists of 2 water coolers.

"If the geometric dimensions of the specimen appreciably exceed the ultrasonic wavelength, it follows that for an isotropic medium the relationship between the propogation velocities for longitudinal and transverse waves and the elastic constants is expressed using the known relationships

$$\mu = 2 - (c_\ell/c_{tr})^2/2-2(c_\ell/c_{tr})^2 \qquad (1)$$

$$G = p \cdot c_{tr}^2 \qquad (2)$$

$$E = 2G\ (1 + \mu) \qquad (3)$$

where μ is the Poisson coefficient, G is the shear modulus, E is Young's modulus, c_{tr} is the velocity of the transverse waves, c_ℓ is the velocity of the longitudinal waves, and p is the density of the specimen material.

In order to study the temperature dependence of the velocity (to find the values of velocity over each temperature section of the specimen), it is necessary to plot a family of graphs for the temperature distribution and to measure the average value of the propogation time for vibration along the specimen for each case." (Source: Electronics Express, Vol. 3, No. 10, 1961, p. 25)

NEW NEUTRINO HYPOTHESIS. At a recent conference on cosmogony, B. M. Pontecorvo and Ya. A. Smorodinskiy reported on their new "neutrino hypothesis of the evolution of the universe," which holds that during the initial stages of evolution most of the mass of the universe consisted of high-energy neutrinos and antineutrinos, rather than of protons, neutrons, and electrons. This would explain the apparent preponderance of particles over antiparticles, since in view of the vast number of neutrinos and antineutrinos any asymmetry in the distribution of material particles would hardly affect the total balance of matter in the universe and could be considered a local fluctuation. According to the hypothesis, neutrinos and antineutrinos lose their energy as the universe expands. An experiment which would include one of the nuclear reactions generated by antineutrinos, suggested by the Soviet physicist Kharitonov to measure the density and total mass of neutrinos in the universe, was also discussed. It is expected that the experiment would show that in our region of the universe the total mass of antineutrinos is greater than that of neutrinos, a result which would compensate for the disparity between the material particles and antiparticles. (Source: Literaturnaya gazeta, December 2, 1961, 4, Cols. 1-6)

INNER RADIATION BELT. According to results obtained from processing of data collected by Lunik 2, the following areas showed an extremely high radiation count: the South Atlantic near the shore of Brazil, the South Indian Ocean, the South Pacific, North America, and Siberia. A large negative anomaly was also registered in the South Atlantic near

Brazil. The data were obtained at an average altitude of 320 km. (Source: Akademiya nauk SSSR. Doklady, Vol. 140, No. 4, October 1, 1961 p. 787-790; Ibid., No. 5, October 11, 1961, p. 1041-1044)

RADIO EMISSION FROM THE TAURUS A SOURCE. A series of observations of the Taurus A radio emission source was conducted by the Physics Institut imeni P. N. Lebedev, Academy of Sciences USSR, during March and April of 1961. The observations were made on the 8-mm wavelength with the use of a 22-m radiotelescope. The sensitivity of the radiometer which served as a receiver was 1.5°K with a time constant of 5 sec. The experimental recording of the radio emission from the Taurus A region showed the presence of a second maximum point separated by 36 sec from the maximum point which represents the position of the Taurus A source. It is suggested that the second maximum may represent a previously unidentified source of radio emission. The antenna temperature of this source was found to be 2.8°K (±10%), the brightness temperature 7°K (±25%), and the emission flux density $130 \cdot 10^{-26}$ w/m^2·cps (±25%). The mean value of the antenna temperature of the Taurus A source was determined to be 4.5°K (±10%), the brightness temperature 6°K (±10%), and the emission flux density $500 \cdot 10^{-16}$ w/m^2·cps (±2.5%). (Source: Akademiya nauk SSSR. Doklady, Vol. 140, No. 1, September 1, 1961, p. 81-83)

ON BOOKS. The following book reviews have been selected from various publications as noted:

Koldovsky, M., Photography in Meteorology, Halle/Saale (East Germany), Foto-Kino-Verlag, 1961.

This review, by Dr. Herman E. Fincke, was obtained from the JENA REVIEW, Volume 4, 1961.

"According to an introductory remark by the author, this book is the first dealing with photography in scientific meteorology. It must therefore be presumed that the author has the requisite knowledge of scientific and applied photography, and on the other hand has a clear idea about its application within the scope of his specialized field. Both of these can be fully confirmed. The book is characterized by a high degree of scientific accuracy which is also pleasing in its conciseness and precise description. The author commences with a brief description of applied photography, e.g. with the properties and types of negative material with regard to their suitability for the photographic problems of meteorologists; and deals subsequently with the prerequisites for obtaining perfect exposures. He proves thereby a high degree of insight into the optical relationships, i.e. with respect to the laws of image-formation as well as with respect to the physical influences which play a part in atmospheric processes. Among these are ligh scattering in the atmosphere, causes and types of polarization, the different luminous densities in parts of the celestial globe and its apparent flattening. In this connection, attention is also drawn to the suitable use of light filters. The text is supplemented by good photographs as well as graphical illustrations and tables.

In the chapter on scientific photography of clouds, various photographic techniques, photogrammetric cloud surveying and special cameras for celestial photography are discussed. Of no less interest to the professional meteorologist, and also for the professional and amateur photographer, are the chapters on photographic recording of radiation phenomena, amongst which are the aurora borealis and the photography of lightning discharges. It would be of advantage to the reader if he could also have a look into the "workshop of the weather-makers", i.e. to learn at least something about the evaluation of photographic material, which may, however, supply only part of the required scientific data. Perhaps the author will decide to follow this book up with an equally clear and concise description of practical meteorology.

In conclusion the author explains by means of intuitive illustrations the part of photography in obtaining basic scientific information, for instance, on processes of ice crystallization, on flow examination, for gaining information about the upper atmosphere by photographing the tracks of meteors with the help of special instruments, etc. Of great interest also are the photographs taken from weather rockets at an altitude of several hundred kilometers.

The reviewer would like to point to a possible misunderstanding. In the section on macro-photography, the author states at the top of page 102 the following verbatim: "...because with normal lenses we have to stop down to at least 5.6 to eliminate the optical defects of the lens...". With these "defects of the lens" he can only mean the plausible effect which occurs when using lenses corrected for infinity for extremely short subject distances and which is compensated by a smaller aperture. A stopping down is already required in order to obtain the necessary depth of focus. But it can definitely not be concluded from the above that with modern quality lenses stopping down is generally done to reduce residual errors. The lens correction is today so excellent that depiction at full aperture is likewise free from aberrations. We thank the author Milan Koldovsky, who is working as a meteorologist in the USSR, for this interesting insight into a hitherto little known field of scientific and applied photography, and we also thank the Foto-Kino-Verlag Halle for publishing his book."

Timmerhaus, K. D. (Editor), Advances in Cryogenic Engineering, Vol. 6, New York, Plenum Press, 1961.

Mr. M. Ruhemann in his review of this new book for CRYOGENICS (Vol. 2, No. 1, September 1961, p. 54) makes the following comments:

"Volume 6 of ADVANCES IN CRYOGENIC ENGINEERING - the Proceedings of the 1960 Cryogenic Engineering Conference held at Boulder, Colorado - establishes even more clearly than its predecessors the position of Cryogenics as an independent field of applied science. Sixty-seven papers attractively printed on 649 pages cover an immense range of research and development primarily on the practical application of temperatures which, a few years ago, were the exclusive preserve of laboratories experimenting in pure physics. The impression is gained that we are witnessing the birth of a whole series of new industries the development of which will be based on the efforts of a new type of specialist - the cryogenic engineer. Just as the chemical engineer emerged as a synthesis of the mechanical engineer and the chemist, so the cryogenic engineer is being molded from the mechanical engineer and the low-temperature physicist. Just as the chemical engineer of today is more than just a combination of an engineer and a chemist, so the cryogenic engineer of tomorrow will be more than the sum of his two component parts.

"Until very recently all attempts to bring together technologists and low-temperature physicists in conferences and research establishments have been singularly abortive. For many years the two species have refused to interbreed. Whereas science was advancing rapidly down the logarithmic temperature scale and discovering a wealth of new and fascinating phenomena, industry had stopped short at the 80°K level which it had reached with the creation of the oxygen industry over half a century ago. The volume under review may help us to understand why, in the U. S. A. at least, this position has suddenly changed.

"The Proceedings are grouped, rather lamely, under a variety of headings, of which Space Technology is the first, and this endorses the fact that it was rocketry and its use of cryogenic fluids as propellants and oxidants which gave the initial impulse to cryogenic development. A number of technical problems have to be solved before liquid hydrogen and liquid oxygen can be combined in a successful rocket, problems of large scale liquefaction, storage, insulation, etc., all of which are treated in the volume under review and in its predecessors. It was the importance of these developments in the military sphere which provided the initial capital to launch cryogenic engineering, coupled with considerations of national prestige in space exploration. But once it was established that refrigeration at very low temperatures could be made available on a large scale, the industrial application of the low-temperature properties of matter became a practical possibility. Thus a number of papers are devoted to various applications of superconductivity (motors, rectifiers, magnets, etc.), which all require refrigeration to liquid helium temperatures; one contribution describes a completely new cycle for producing refrigeration in this temperature range and another deals with a refrigerator using helium-3 as the working substance for temperatures around 0·5°K.

From the general tenor of the contributions, it is easy to forecast for a growing demand for bulk quantities of liquid hydrogen for direct consumption. Liquid helium, on the other hand, will be required primarily as a source of low temperature, localized in many cases to appliances of very restricted volume. There is a need here not only for an easily available supply of bulk cold liquid, but also for an independent low-output unit for 'point refrigeration'."

Wiener, Norbert, Cybernetics. 2nd Edition, 1961.

Publishers: The M. I. T. Press, Cambridge, Mass., and John Wiley and Sons Ltd., Gordon House, Greencoat Place, London.

"Dealing with the close study of human control functions and of the mechanical and/or electrical systems designed to replace them, cybernetics itself is a new science, actually named by Dr. Wiener and his colleagues in 1947. Because of its nature, it touches on every branch of science in which control or communication plays a part, and stems from the results of a wide theoretical study and experimentation by the author, who is Professor of Mathematics at the Massachusetts Institute of Technology, and a number of outstanding scientists.

"The book represents the first complete statement of the science of control and communication in animals and machines, with its many ramifications and ever-increasing implications for science and human existence in general. In a very strict sense, it describes the application of methods of statistical mechanics to communications engineering, with subject matter ranging from such control mechanisms as mathematical calculators to the nerves and brain of the human body. This new and revised second edition has been completely re-edited and includes a new introduction by the author and two completely new chapters, i.e., on learning and self-reproducing machines, and on brain-waves and self-organizing systems. It should also be added that, although the subject is an interesting one, Dr. Wiener contrives to make it even more interesting by his lucid and concise style of writing." (Source: The Engineer's Digest, Vol. 22, No. 10, October 1961, p. 26)

ON SELECTED BIBLIOGRAPHIES. The following translations were selected from the U. S. Department of Commerce, Office of Technical Services, Technical Translations, Volume 6, Number 11, dated December 12, 1961. Persons within MSFC desiring information on ordering and cost of translations should contact M-MS-IPL, telephone 876-8386.

ASTROPHYSICS

Barabashov, N. P., Bronshten, V. A., and others, The Moon. May 23, 1961, 519 p.

This collection of monographs was written by a group of Soviet scientists who have studied the natural satellite of the Earth for many years, and edited by A. V. Markov. The purpose of the book is to provide astronomers and other specialists with an all-inclusive and critical presentation of the data on the motion, structure, and physical nature of the Moon which have been accumulated to date. Chapters are devoted to: (1) The motion, rotation and figure of the Moon; (2) Lunar cartography and selenographic coordinates; (3) Description of the lunar surface; (4) The problem of the atmosphere of the Moon; (5) The physical properties of the lunar surface; (6) Studies of the Moon by radio methods; (7) Characteristic features of the relief of the Moon. Basic problems of the genesis and sequence of development of lunar formations; (8) The role of external cosmic factors in the evolution of the Moon; (9) The nature of the lunar surface.

Polozova, N. G., The Application of Electronic Computers to the Construction of the Theories of Planetary Motions. August 3, 1961, 66 p. 16 refs.

SCIENTIFIC PERSONNEL

n.a., Biographies of Selected Soviet Scientists. August 30, 1961, 34 p.

ANATOMY AND PHYSIOLOGY

Baevskii, R., Biotelemetry and Space Flight. September 1, 1961, 8 p.

Radiotelemetry is the basic means of investigation in space medicine. (Author)

Gyurdzhyan, A. A., Some Problems of Securing Vital Living Conditions in Space Flight (Nutrition, Water Supply, Air Regeneration, Sanitation). August 31, 1961, 17 p. 47 refs.

ANALYTICAL CHEMISTRY

Pavlinova, G. N., Rapid Method for the Determination of Antimony in the Presence of Arsenic. July 10, 1961, 13 p. 7 refs.

The separation of acid during the mixing of a solution of $SbCl_3$ with a solution of neutral tartrate was demonstrated. Arsenic and pentavalent antimony do not interfere with the determination. The possibility of determining antimony in babbit B-N by means of tartrate without preliminary determination of the arsenic is demonstrated.

ORGANIC CHEMISTRY

Eidus, B. R., Dependence of the Hydrogen-Carbon Ratio in Liquid Fuel Upon Its Average Specific Gravity. 1961, 6 p. 12 refs.

On the example of a large number of organic compounds the hydrogen-carbon ratio was correlated with specific gravity. An equation $(H/C)' = 3.86 - 2.3D$ was derived suitable for comparative characterization of crude oils with tars from coal and peat. Similar equations were derived for the series of paraffins and naphthenes. (Author)

Shigorin, D. N., Rodionov, A. N. and others, Investigating the Nature of Secondary Chemical Bonds. March 20, 1961, 9 p. 13 refs.

PHYSICAL CHEMISTRY

Klyachko, Y. A. and Larina, O. D., A New Method of Determination of Gases in Metals. March 1961, 8 p. (1 fig. omitted) 6 refs.

As a result of anodic dissolution of metal, in addition to the precipitation of phase-differentiated inclusions, liberation of gases occluded in metal takes place. Upon destruction of the crystal lattice of metal, atoms of gaseous elements, whether present in solid solution or bonded to the surface, become liberated and must either recombine, with the resultant formation of the appropriate gases, or become ionized and pass into solution. In addition, molecules of gases present in the form of mechanical inclusions as well as those in the adsorbed condition must also be liberated. On the basis of this, a complex method was developed for the complete determination of gases in metals, permitting the differentiation between the forms of the gases. (Extract)

EARTH SCIENCES

Elyasberg, P. E. and Yastrebov, V. D., Determination of the Density of the Upper Atmosphere from the Results of Observations of the Flight of the Third Soviet Artificial Earth Satellite, tr. by Joseph Gallant and George Hill. July 21, 1961, 23 p. 4 refs.

Pogosyan, Kh. P., Jet Streams in the Atmosphere, tr. by Richard M. Holden. March 1961, 190 p. 121 refs.

This monograph contains the results of an investigation of tropospheric and stratospheric jet streams over the northern hemisphere. The structural characteristics and other characteristics of jet streams over Eurasia are discussed in detail. Separate sections are devoted to the origin, evolution and dissipation of jet streams, their connection with atmospheric fronts, pressure formations, etc. The monograph contains charts, graphs and tables, including: individual and mean-monthly vertical cross sections of the atmosphere between the equator and the North Pole up to 28-30 km in different longitudinal zones of Eurasia and different seasons of the year; data on the temperature regime and charts of the average wind speeds (isotachs) of the upper troposphere and the stratosphere; pressure topography charts of the main isobaric surfaces for the winter and summer of the northern hemisphere, etc. A separate chapter is devoted to the problems of the formation of the stratospheric temperature and wind fields and an attempt is made to represent the vertical winter and summer temperature distribution and the atmospheric circulation up to 90-100 km. This monograph is written for scientists and for a wide circle of meteorologists and students in advanced schools of meteorology. (Soviet publisher's note)

Zatrutina, R. F., compiler, The International Geophysical Year (Bibliography) of Literature in the Russian Language During 1954-57. July 1961, 48 p.

This bibliography contains more than four hundred and fifty titles of books and articles devoted to the International Geophysical Year and published in the Russian language in the period 1954-1957. It contains both scientific and popular science literature on the general questions of the IGY, and on the divisions of research included in the IGY program. Also included in this bibliography are works describing the activities of the combined Arctic and Antarctic expeditions organized in connection with the IGY. Since the majority of the publications are of a preliminary character and contain little information referring to the results of research in the IGY program this bibliography includes popular literature and some newspaper articles. The bibliography is partially annotated and is arranged in a systematic order. Within each section the items are arranged alphabetically (Cyrillic) by author, or by the title for those works published without reference to the author. Literature devoted to research with the aid of rockets and artificial earth satellites have been omitted. (Compiller)

ENGINEERING

n.a., Engineering (Mechanical, Electrical, Aeronautical, Nuclear, Petroleum, Structural, and Civil) Machinery and Equipment (General and

Special Purpose) No. 7. Series 4 of English Abstracts of Selected Articles from Soviet Bloc and Mainland China Technical Journals. August 1961, 70 p.

CHEMICAL ENGINEERING

n.a., Liquid Oxygen Technology in the USSR. May 26, 1960, 48 p. 24 refs.

Contents:
Development of oxygen production in the USSR
Specifications and schematic drawings of Soviet oxygen plants
Tables of names and characteristics of Soviet oxygen plants
Specifications and drawings of containers for transporting liquid oxygen
Bibliography

ELECTRICAL AND ELECTRONIC ENGINEERING

n.a., Improved Method for Encapsulating Semiconductor Elements. October 10, 1961.

n.a., New Techniques for Assembling Semiconductor Devices. October 10, 1961.

n.a., New Transistor Design to Selectively Amplify Two Different Frequencies with a Single Unit. October 10, 1961.

n.a., Semiconductor Elements Sealing Procedures to Insure Complete Moisture-Proof and Sufficient Thermal Conduction. October 10, 1961.

n.a., Special Alloying Process for Forming Transistor Electrodes. October 10, 1961.

Aizerman, M. A., Theory of Automatic Control. 1961, approx. 600 p.