Space INTELLIGENCE NOTES

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

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FROM THE WORLD PRESS

FROM THE SEMITECHNICAL LITERATURE

FROM THE TECHNICAL LITERATURE

FROM THE WORLD PRESS

ANOTHER COSMONAUT READY TO ORBIT. Soviet Cosmonaut Gherman S. Titov, at a news conference on May 2nd, stated that his country has "Cosmonaut No. 3 ready to go," but he refused to give details or any further information.

Grinning broadly, Titov told a crowded conference room of newsmen at the Soviet Embassy in Washington, D. C., that Russia had an ample supply of trained space pilots. He declined to name any fixed number, explaining through an interpreter that he felt this did not have "any principal importance."

When asked at what time in the future Russia would allow the world to watch orbital flight launchings, Titov said this would depend upon progress toward world disarmament. Afterwards, he predicted that he and his listeners would witness flights to and around the Moon, some carrying passengers. (Source: Washington Post, May 3, 1962)

SOVIETS DENY COSMONAUT LOSSES. Moscow radio recently launched a diatribe against the American columnist Drew Pearson for reporting that probable Soviet failures in outer space resulted in the loss of at least five cosmonauts.

Said Moscow radio: "He even named some of them--Aleksei Ladovsky, Terenty Shubarin, and Andrey Mitkov."

A Novosti correspondent inquired of Leonid Sedov, leading Soviet space expert, for his opinion of the Pearson article. He declared, "The U.S.S.R. has not made a single attempt to put a man into space, either before or after the flights by Gagarin and Titov. This fact has been announced at official press conferences by our scientists and spacemen.

"Pearson claims that there was so much contradictory in Gagarin's reports that his orbital flight appears doubtful. The US journalist alleges that similar contradictions were also discovered on Titov's 17-orbit flight.

"Apparently, Pearson is not very sure of himself, anyway, because he wrote further on that US officials who carefully tracked both Soviet flights were convinced that there actually were spacemen in the rockets.

"If both our countries were to unite their efforts, scientific, technical, and material, for the conquest of space, it would be very useful for the development of science and would be received with joy by all nations which want scientific achievements to serve man, but not to be used for the cold war and the armaments drive. Such was the message Premier Khrushchev sent President Kennedy. Two days later, Pearson came out with his article of hidden dissatisfaction and malice, as if it were from the depths of hostility and discord.

"'As for the fable of the five dead Russian astronauts which Drew Pearson is distributing,' said Radio Moscow, quoting Sedov, 'I can say one thing. If it was thought up by a journalist, he could just as easily have put to death another ten Soviet astronauts or so.'"

NOTE--The column which Radio Moscow refers to gave considerable detail regarding the dates and nature of the flights reported to have been taken by the unsuccessful Russian astronauts. The column made the point that it was Soviet secrecy that had raised the question about the flights of Gagarin and Titov, in contrast to President Kennedy's policy of complete publicity.

The column quoted Lt. Col. John Powers, spokesman for the American astronauts, as saying there were "so many inconsistencies in the report by Gagarin as to lend doubt as to whether he was the cosmonaut who went into orbit." The column further reported: "American officials monitored both flights closely and are convinced that cosmonauts were aboard, as the Russians claimed." (Source: Washington Post, April 6, 1962)

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FIRST INTERNATIONAL SPACE LAUNCHINGS SUCCESSFUL. On April 26, the first international spacecraft, a 132-lb paddle-wheel satellite constructed by the US and carrying British instruments, was placed in orbit from Cape Canaveral. Also on the same day, a US-Japanese sounding rocket was successfully launched from NASA's Wallops Island site.

The US-British spacecraft, designated S-51, is carrying instruments to acquire more knowledge of the ionosphere and its complex relationship with the Sun. The craft has six devices for an integrated assault on the unknowns of the ionosphere, the radio reflective layer which begins some 35 miles above the Earth, where the atmosphere is extremely tenuous. In this region, incoming high-energy radiations from the Sun--X-rays and ultra-violet--collide with air molecules and atoms, freeing electrons and leaving positively charged electrified atoms, or ions.

These clouds of free electrons and charged ions form a succession of electrically charged layers that extend up to where the Earth's atmosphere merges with outer space. The ionosphere filters out dangerous Sun radiations and at the same time acts as a mirror to radio waves, making possible communications across international distances.

The S-51 carries three ionospheric instruments to measure electron density and temperature and the composition of positive ions. Two other devices will attempt to monitor the intensity of ultra-violet radiation from the Sun's surface, or chromosphere, and of X-ray bands in the solar corona. The sixth instrument will attempt to measure cosmic rays.

The US-Japanese experiment consisted of separate Japanese and US probes attached to a Nike-Cajun sounding rocket. The Japanese instrument was designed to permit much faster study of the composition of the ionosphere.

Launching of the ionosphere sounding rocket, which reached an altitude of 75 miles, was the first of three scheduled Japanese-American flights. It is expected to lay the basis for the joint launching of a scientific satellite. (Source: New York Times, April 29, 1962)

SEVEN NATIONS JOIN EFFORTS IN SATELLITE PROJECT. Australia, Belgium, France, West Germany, Italy, the Netherlands, and Britain have signed an agreement for the establishment of a European satellite launcher development organization, British Aviation Minister Peter Thorneycroft reported on April 15.

The initial program, now under way, provides for the development of a launcher using the British Blue Streak rocket as the first stage. A French rocket would be used as the second stage, and West Germany would lead development of the third stage.

The design, development, and construction of the first series of satellite test vehicles would be carried out under Italian leadership. Belgium would be in charge of equipment for the ground guidance stations and the Netherlands of the long-range telemetry links.

Development firings of the first stage and of the complete three-stage launcher would be carried out at Woomera, the Australian test range. (Source: Washington Post, April 17, 1962)

US AND USSR AGREE ON WEATHER SATELLITES. United States and Soviet scientists have agreed on a proposal to establish a "world weather watch" consisting of a network of regional forecasting centers linked by meteorological satellites.

Dr. Harry Wexler, Director of Research in the US Weather Bureau, and Dr. Viktor A. Bugaev, Assistant Director of the USSR Hydrometeorological Service, met in Geneva last month to draft the plan. Their work is an outgrowth of a UN resolution made last December and the Kennedy-Khrushchev letters. The meeting was held at the headquarters of the World Meteorological Organization (W.M.O.), an agency of the United Nations, and was

very successful. On May 22, the proposal will be submitted to the W.M.O. panel of experts on the use of weather satellites. Although the Soviets have previously boycotted such meetings, it is believed they will send a representative this time. The plan will then be reviewed by the W.M.O. executive committee and referred to the UN Committee on the Peaceful Uses of Outer Space.

Details of the plan were disclosed by Dr. Wexler in Washington, D. C., on April 23rd. The plan calls for expanding and improving global observation of the weather by both conventional means and new methods made possible by development of weather satellites.

On the conventional side, for example, the proposal calls for a substantial increase in the number of observation centers, particularly in the Southern Hemisphere where weather observations are now sparse. Also called for is the establishment of regional and world centers to collect, analyze, and dissiminate weather information.

To avoid duplication of efforts, it is proposed that underdeveloped nations pool their resources by establishing regional centers for making forecasts in their areas.

As for weather satellites, the plan calls for cooperation in the launching and international dissemination of their meteorological information.

Dr. Konstantin T. Logvinov, Deputy Director of the Hydrometeorological Service, stated that the USSR wants to cooperate in this program. He emphasized, however, that "concrete steps" by the USSR would have to await adoption of the proposal by the W.M.O. and the UN.

Dr. Logvinov indicated that his country was not as advanced in developing weather satellites as the US. "We are just learning from American experience," he said when asked if the USSR was developing comparable weather satellites. The last two USSR satellites, he explained, contained instruments for measuring radiation from the Earth's atmosphere but no cloud cover cameras. (Source: New York Times, April 24, 1962)

AFTER ONE YEAR--SOME DETAILS OF GAGARIN'S FLIGHT RELEASED. On April 12, 1961, the Soviet Union sent the first man into space--Yuri A. Gagarin. To commemorate his achievement, Pravda last week published, for the first time, a partial text of the spaceman's conversation with Vostok control during and before that historic flight.

The transcript begins 1 minute before the launching of the Vostok capsule:

Control: Understood. One-minute readiness. How do you hear me?

Gagarin: Understood. One-minute readiness. Initial position taken.

Control: Understood. Liftoff!

Gagarin: Go! Everything is going normally. I feel fine.

Control: We all wish you a good flight. All normal.

Gagarin: Goodby! Until we meet again soon, dear friends.

Control: Goodby.

Gagarin: Vibration lessening. Noise increasing slightly.

Control: Time 70. (70 seconds from beginning of launch.)

Gagarin: Understood, 70. I feel fine. Am continuing the flight. Gravity is increasing. All well.

Control: How do you feel? One hundred seconds from beginning of launching.

Gagarin: I feel fine. How is it with you?

Control: Speed and time normal. How do you feel?

Gagarin: Jettisoning main streamlining. I can see the Earth. Gravity increasing slightly. Flight going well. Gravity is growing. Slow rotation. I am bearing it all well. Gravity not great. I feel fine. I am watching the Earth through the porthole. More clouds.

Control: Everything is going normally. Understood. Hear you excellently.

Gagarin: Visibility good. I can discern and see everything. Some area covered by cumulus clouds. The flight is going successfully. In weightlessness I feel normal. I feel well. All instruments, the whole system is working well. What can you report to me? How do you hear me? I am giving a regular report. 9-H. 48-M. The flight is going successfully.

Gagarin: I feel well.

Control: Understood.

Gagarin: Solar orientation is switched on.

Control: Understood. Flight going normally. Orbit as calculated.

Gagarin: Understood. Attention. I am in the shadow of the Earth.

Control: Understood.

Gagarin: I feel fine. Am continuing the flight. I am over America.

Control: Understood.

Gagarin: Attention! I can see the horizon of Earth. What a beautiful halo! At first a rainbow from the very surface of Earth, and a rainbow is passing below. Very beautiful. It all passed by the righthand porthole. I can see the stars through the porthole. Attention. Attention. I have come out of the shadow of the Earth. The appearance of the sky is visible through the right porthole. The solar system of orientation is working. The flight is going successfully. I feel fine. All systems working well. Am continuing the flight.

(Source: Washington Star, April 15, 1962)

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PURGED RED NOW HAILED AS ROCKET PIONEER. Soviet Marshal Mikhail Tukhachevsky, who was executed in 1937 on Stalin's orders and later exonerated in 1956, was honored on March 24 of this year as an early advocate of military rockets.

The official military newspaper Red Star, said Tukhachevsky insisted as far back as 1932 on development work on the construction of rocket engines and that he persisted in these efforts until he was convicted in 1937 as a result of an unjustified persecution. (Source: Washington Post, March 25, 1962)

FROM THE SEMITECHNICAL LITERATURE

OXYGEN DISCOVERED IN VENUSIAN ATMOSPHERE. Tass, Soviet news agency, reported last month that astronomers of the Crimean Astrophysical Observatory have discovered molecular oxygen in the outer atmosphere of Venus. The astronomers made their find with a 157.6 in. solar telescope and a special spectograph. There were also reported indications that nitrogen is present in the atmosphere. (Source: Aviation Week, April 16, 1962, p. 77)

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ARE SOVIET SATELLITES MONITORING US A-TESTS? Soviet Russia on April 24 and 26 launched the third and fourth satellites in their Cosmos series. These satellites are orbiting in excellent positions to monitor the ionosphere during the US nuclear test series which began on April 25.

Tass news agency said the satellites will study weather, communications, and the effects of radiation on man during prolonged space flights. Because of the number of satellites launched and coincidence with the

A-tests, it is strongly suspicioned that the payloads contain radiation sensors and counters and possibly television cameras. Suspicion is strengthened by the fact that this is the first time the USSR has orbited two satellites in such a brief time.

Tass said Cosmos 3 is orbiting at an inclination of 48 deg 59 min between altitudes of 141.98 and 446.4 mi. Orbital period is 93.8 min. Cosmos 4 has an inclination of 65 deg; apogee is 206 mi and perigee is 186 mi. Its period is 90.6 min. Its inclination indicates a different launch point than the first three Cosmos satellites.

The Cosmos series has been shrouded in even more secrecy than normal, particularly for what are announced as scientific satellites. Neither weights nor sizes of payloads of the Cosmos satellites has been released. (Source: Aviation Week, April 30, 1962, p. 27)

ON THE ATOM BAN AND SOVIET CBR. The United States' top CBR expert predicts a likely Soviet speed-up of chemical and biological warfare activities in the wake of a nuclear weapons ban.

Major General Marshall Stubbs sees the Soviet potential for biological operations as one that "could be developed into a major threat."

If a nuclear weapons ban is achieved, says the Army's Chief Chemical Officer, "there is every possibility that the Soviets will turn to chemical and biological weapons."

General Stubbs' views, recorded in closed-door Capitol Hill testimony, were supplemented with classified information which was not made public.

He said the Soviets are believed to have a strong capability to wage warfare with chemical weapons and a strong potential for biological operations which could be developed into a major threat.

Studies and experiments by his organization, General Stubbs said, have demonstrated that materials artificially introduced into large scale air-mass movements can be carried over extended distances for relatively long periods of time.

Such transportation is also available to the Soviets. In more academic language, he explained it thusly: "Climatological surveys have also been completed which indicate that the predictable synoptic system occurs over all of the large land masses of the World that would lend themselves to the transport of particulate material to the distances mentioned...." (Source: Army, Navy, Airforce Journal and Register, Vol. XCIX, No. 34, April 21, 1962)

CHINESE ARE TRAINING ASTRONOMERS. The following note is based on an article appearing in the Peiping newspaper called Kuang-ming Jih-Pao.

The Astronomy Department of Peiping Teacher's University was organized in 1958 from the astromathematics section of the Physics Department. In order to improve their skills, young instructors in the department have built a solar observatory to study the solar spectrum and a radiation telescope to study solar radiation. These same instructors have organized courses in basic astronomy, astrophysics, and the astronomy of fixed stars.

During the past 3 years, instructors on the staff have written five papers on Sun spots. Among these instructors are Tu Chin-sheng (instructor) and Lai Ch'un-ming (researcher). Feng K'o-Chia is chairman of the Astronomy Department and Li Chih-an is a young instructor on the department's staff. (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 2)

RUSSIANS PLAN WORLD'S LARGEST TELESCOPE. Academician L. Artsimovich, quoted in Izvestiya, states that the creation of a new type of scientific institute--an institute of theoretical astronomy--is an immediate necessity.

He feels that the goal of this new institute must be the use of satellites and spaceships for astronomical research and the development of new scientific apparatus for use in satellites, rockets, and future planetary stations. The revolutionary changes in space science and astronomy are based on the use of satellites and spaceships as a new method of making astronomical observations. This has advanced the investigation of the solar system to the forefront of current astronomical problems and has laid the foundations of a new science--theoretical astronomy.

Astronomers have acquired the possibility of probing areas near the Sun and observing the full range of streams of particles emitted by the Sun into surrounding space. Astronomers have before them the opportunity of directly acquainting themselves with the nearest planets through use of automatic stations, telescopes on the Moon, and the study of gamma rays arising with the annihilation of anti-matter in distant galaxies.

Artsimovich goes on to say that the attention of Soviet astronomers is now drawn to the gigantic telescope which the USSR will build in the very near future. This telescope, which will be the largest in the World, will be set up on one of the summits of the Northern Caucasus and in the future will be surrounded by other astronomical facilities. (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 2)

FROM THE TECHNICAL LITERATURE

ASTRIONICS

SOME PROBLEMS IN MISSILE GUIDANCE. O. V. Grigor'yeva and A. S. Kel'zon elaborate on some specific guidance problems in Aviatsoinnaya tekhnika, No. 4, 1961.

The conditions of stable missile guidance with consideration of the inertia of the controlling airfoil are discussed for the following cases of homing: (1) with a zero lead angle (pure pursuit course); (2) with a constant lead angle (deviated pursuit course); and (3) with the use of the proportional navigation course (approach).

The limit values, in pursuit courses, of the velocity and acceleration of the control-flap declination in the final stage of approach are determined from given formulas for certain values of $k = v_s/v$ (v_s = speed of the target, v = speed of missile inertia center). In the proportional navigation course, equations of motion are given for the navigational correction A = 2; the solution shows the relationship between the angle of control-flap declination and the lead angle. This relationship insures that the controlled object will follow the trajectory exactly. The condition for hitting the target is $p > 1$ ($p = 1/k$). The stability boundaries for guidance of the missile in the final stage are calculated from the turning rate of the path, while velocity and acceleration are determined from the control-flap declination. The results are plotted in a diagram from which the effect of the control-flap inertia can be determined.

Since the pursuit courses are particular cases of the proportional navigation course with A = 1, it is concluded that the increase of the navigational correction widens the stability boundaries in the guidance of a missile in the final stage of its flight. (Source: Dept. of Commerce, A.I.D. Press, No. 683, April 10, 1962, p. 1)

ASTRONOMY

RUSSIAN DISPUTE OVER COMET'S TAIL. V. Davydov, Scientific Secretary of the State Astronomical Institute imeni P. K. Shternberg, has disputed Academician B. P. Konstantinov's explanation for the fact that two tails, one pointed toward the Sun and the other away from it, were observed on Arend-Roland's comet during its 1957 appearance. Konstantinov had attributed this phenomenon to solar attraction and repulsion, i.e., the Sun has an intense positive electric field which attracted negative particles in the comet and repulsed positive particles. According to Davydov, the second tail was an optical illusion. He contends that since the Earth was in the orbital plane of the comet during its appearance, the comet's matter, scattered into this plane and illuminated by the Sun, seemed to be a second tail directed toward the Sun. (Source: Dept. of Commerce, A.I.D. Press, No. 676, March 30, 1962, p. 1)

ASTROPHYSICS

MEASUREMENT OF THE OUTER RADIATION BELT. In the December 1961 issue of Geomagnetizm i aeronomiya, S. N. Vernov and associates report that the Venus rocket launched on February 12, 1961, carried two radiation counters intended for measurements in the outer radiation belt located 30,000 to 45,000 km from the Earth's center. The first counter was a CTC-5 gas-discharge device 5 cm in length and 1 cm in diameter, with 50 mg/cm^2 stainless-steel walls, capable of making up to 10^5 readings per sec. The second, a scintillation counter with a 20 by 20-mm NaI(Tl) cylindrical crystal, recorded both the crystal output and the number of times the output exceeded 30 kev, and could make up to 10^6 readings/sec.

Both counters recorded energies of over 3 Mev for electrons, over 32 Mev for protons, and over 30 kev for bremsstrahlung quanta. The average crystal output per reading was 130 kev and was found to remain constant at altitudes of 32,000 to 40,000 km. The average quantum energy of bremsstrahlung observed on the outer casing of the rocket did not change with altitude.

A comparison of these data with those obtained from other rockets (since 1959) indicates that the upper zone of the outer radiation belt, in the absence of magnetic perturbations, remained stable in the intervening 2 years. (Source: Dept. of Commerce, A.I.D. Press, No. 677, April 2, 1961, p. 1)

CELESTIAL MECHANICS

ROTATION OF THE CIRCULAR ORBIT OF A SATELLITE. V. F. Illarionov and L. M. Shkadov have reported on their study of the motion of a body along a circular orbit under the action of a transverse force in Prikladnaya matematika i mekhanika, Vol. 26, No. 1, 1962.

The system of equations of the motion of a mass point in the central gravitational field is taken, and the initial conditions are established on the assumption that the circular orbit of nonperturbed motion is located in the equatorial plane. With the components of the transverse force being taken into account, a differential equation in Θ (where Θ is the deviation of the satellite from the initial orbit) is derived from the motion equations, the deviation being a periodic time function when the transverse force is constant. General solutions of equations describing the trajectory of perturbed motion are derived, and it is shown that the trajectories are located in a plane; the angle of this plane with that of the nonperturbed trajectory is determined.

The case of discontinuous action of a transverse force, in the form of the thrust of an engine with a given amount of propellant, is considered. General expressions for determining the rotation angle of the plane of a

satellite orbit from the plane of nonperturbed motion are derived in terms of transverse force and of satellite velocity attained after exhaustion of the propellant. These expressions are analyzed for various values of the transverse force. (Source: Dept. of Commerce, A.I.D. Press, No. 680, April 5, 1962, p. 1)

CLIMATOLOGY

SOLAR ACTIVITY AND CLIMATE. An article appearing in the Soviet newspaper Komsomol'skaya pravda on March 24 relates to solar cycles and the resulting climatic changes on Earth, particularly in the USSR.

Correlations of dendrochronological and solar-cycle data indicate that cyclonic activity intensifies in years of maximum solar activity. Increased precipitation in these periods is reflected in greater tree growth. The fact that high water levels in the Caspian Sea coincide with increased ice thickness in the polar region has now been attributed indirectly to solar activity. When anticyclones prevail over the central and southern parts of the European USSR, strong cyclones develop in the northern regions. These cyclones carry warm air masses from the Atlantic and strengthen warm marine currents, resulting in a decrease of ice. In the south, on the other hand, the anticyclones bring dry air, causing the level of the Caspian to drop.

Heliophysicists have recently discovered that the secular solar activity cycle consists of two clearly defined epochs. Each epoch may last from three to six 11-year cycles, i.e., 33 to 66 years. The first epoch is characterized by decreased solar activity, while the second epoch shows increased activity. The beginning of a new epoch in 1964-1965 should see the introduction of a more continental climate with cold snowy winters and hot dry summers. (Source: Dept. of Commerce, A.I.D. Press, No. 679, April 4, 1962, p. 6)

EARTH SCIENCES

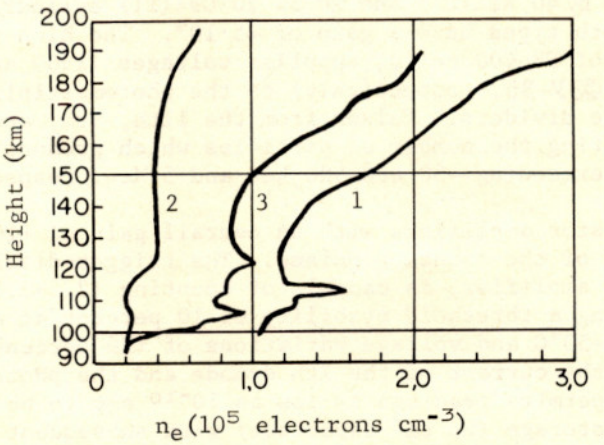
OSCILLATION OF THE EARTH'S CRUST. The Institute of the Physics of the Earth is conducting a continuing study of the solid tides of the Earth. High-precision gravimeters are used to make gravity measurements, and the slope of the Earth's surface is measured by an original instrument designed by A. Ye. Ostrovskiy. The data obtained with these instruments are used to study the elastic properties of the Earth and its core. The theory developed by M. S. Molodenskiy is used as the basis for these investigations.

Indications have been found that the core of the Earth, some 2900 km below its surface, is in a liquid or near-liquid state and that the upper mantle of the Earth has nonhomogeneous elastic properties. The time of

the highest tide in the rigid crust does not coincide with the highest position of the Moon above the horizon; a delay exists which makes it possible to study the viscosity of the deep layers of the crust. The solid tide reaches a height of 50 cm on the equator, and the change in surface slope is about 1 mm in 10 km. The lifting and sinking of the surface occur very slowly. (Source: Dept. of Commerce, A.I.D. Press, No. 674, March 28, 1962, p. 4)

IONOSPHERIC PHYSICS

MEASUREMENT OF IONOSPHERIC ELECTRON CONCENTRATION. During the 1959-1960 launchings of Soviet geophysical rockets up to altitudes of 200 km, measurements were made to determine the electron concentration as a function of altitude $n_e(h)$. Such rocket measurements are free from the uncertainties inherent in radiosonde measurements of the ionosphere from the Earth, and their results may be used in developing methods of correcting the data obtained by ionosphere stations. Figure 1 shows $n_e(h)$ obtained during these launchings.



1. July 14, 1959 (5:40 PM).
2. July 22, 1959 (5:14 PM).
3. June 15, 1960 (4:43 PM).

FIG. 1

The distribution of electron concentration obtained in rocket experiments led to the conclusion that, as a rule, an almost monotonic increase of electron concentration takes place in that part of the ionosphere illuminated by the Sun at altitudes up to 200 km, with small maxima usually occurring at altitudes of approximately 105, 115, and 125 km. The variation in concentration obtained during weak solar illumination (curve 2 on Fig. 1) represents an exception to the general trend. (Source: Dept. of Commerce, A.I.D. Press, No. 689, April 18, 1962, p. 2)

INSTRUMENTATION

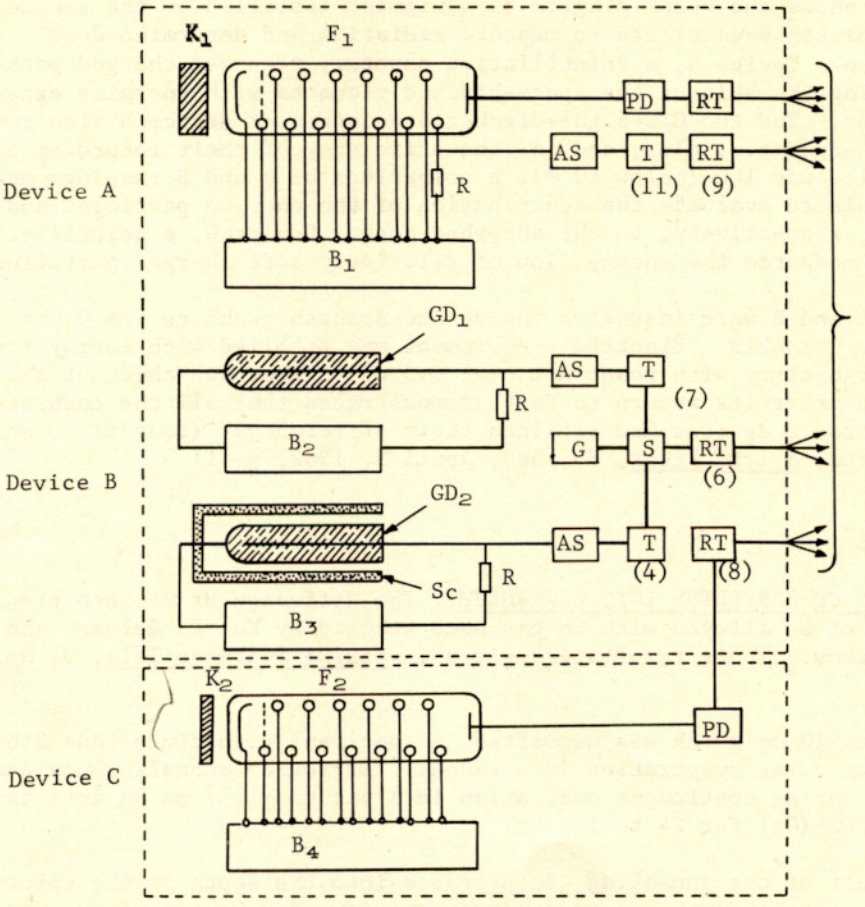
RADIATION-MEASURING SYSTEMS OF SOVIET ROCKETS. According to an article in Geomagnetizm i aeronomiya, Vol. 1, No. 6, 1961, by P. V. Vakulov and several associates, the second and third Sputniks and all Soviet space rockets and spaceship-satellites were equipped with radiation-measuring systems comprising scintillation and gas-discharge counters and shaping, amplification, and scaling circuits.

The scintillation counters use photomultipliers of the types ФЭУ-1С and ФЭУ-35, having 40 by 40 NaI(Tl) and 20 by 20 CsI(Tl) cylindrical crystals, respectively. Both types have a gain of $\sim 5 \cdot 10^4$. The high-voltage battery, consisting of ГВ-400 cells, supplies voltages (1500 and 1200 v for the ФЭУ-1С and ФЭУ-35, respectively) to the photomultipliers without the use of voltage dividers. Pulses from the 11th, 9th, and 8th dynodes are used for counting the number of particles which produce energy yields from the crystal exceeding ~50 and 500 kev and 5 Mev, respectively.

Four-stage transistor amplifiers with an overall gain of ~100 are used for amplification of the counting pulses. The trigger-discriminator, together with the amplifier, is capable of counting $(2.5\text{-}3.0) \cdot 10^5$ pulses/sec and of insuring a threshold stability of 10 percent at ambient temperatures of -30° to +50°C and voltage variations of ±20 percent. Ionization is measured from the current of the 7th dynode and the photomultiplier collector, which permits readings as low as 10^{-10} amp to be made by the method of charge storage (in the capacitor) with subsequent discharge through a neon tube. A СТС-5 gas-discharge counter with 50 mg/cm^2 stainless-steel walls, operating at 400 v, also measures ionization.

Before coming to the scaling circuit, the 50 v negative pulses from this counter pass through a transistor amplifier which changes their polarity and reduces their duration to 8 to 10 μsec. (Source: Dept. of Commerce, A.I.D. Press, No. 690, April 19, 1962)

RADIOMETRIC EQUIPMENT ON SECOND SOVIET SPACESHIP. This note is based on a comprehensive article by S. F. Papkov and others which appeared in Iskusstvennyye sputniki zemli, No. 9, 1961.



A: K_1 - NaI(Tl) crystal (diam 30 mm, ht 14 mm); F_1 - ФЭУ-16 photomultiplier; B_1 - supply battery of photomultiplier (1600 v)

B: GD_1, GD_2 - CTC-5 gas-discharge counters; Sc - grid (1 mm brass, 1 mm steel); B_2, B_3 - counter supply batteries (400 v)

C: K_2 - CsI(Tl) crystal (diam 30 mm, ht 2.2 mm); F_2 - ФЭУ-15 photomultiplier; B_4 - photomultiplier supply battery (1600 v)

AS - amplifying and shaping circuits; PD - pulse forming discharge circuit; T - triggers; RT - interrogation triggers; G - generator (intervalometer); S - switching device; R - resistor. Figures in parenthesis indicate the number of elements.

FIG. 2. Block Diagram of Radiometric Equipment

Figure 2 shows the block diagram of equipment installed on the second Soviet spaceship-satellite to measure radiation and determine dose absorption. Device A, a scintillation counter, recorded charged particles penetrating the skin of the spaceship and γ-quanta with energies exceeding 25 kev. The two CTC-5 gas-discharge counters of device B also recorded charged particles, and, as the efficiency of their recording of γ-radiation was low (below 10^{-2}), a comparison of A and B readings made it possible to evaluate the contribution of the charged particles and the γ-quanta, respectively, to the absorbed dose. Device C, a scintillation counter, measured the energy flow of relatively soft charged particles.

Devices A and B were installed inside the spaceship and device C was fitted to its skin. Electronic equipment was supplied with energy from a 6(±1)-v battery with power not over 0.5 w. A thorough check of the spaceship after its return to Earth demonstrated that all the counters and electronic devices had retained their efficiency. (Source: Dept. of Commerce, A.I.D. Press, No. 680, April 5, 1962, p. 1)

MATERIALS

DIFFUSION OF BERYLLIUM INTO GERMANIUM. The diffusion of Be into single crystals of Ge alloyed with Sb has been studied by Yu. I. Belyaev and V. A. Zidkov. Their results are given in Fizika Tverdogo Tela, 3, No. 1, 1961.

A Be layer 10 mm thick was deposited on specimens with dimensions 2 by 3 by 10 mm using evaporation in a vacuum. Diffusion annealing was carried out during continuous evacuation in a vacuum $\sim 10^{-3}$ mm Hg in a range 920° to 720° (C?) for 24 to 150 hr.

As a result of the annealing, Be diffused into the depth of the specimen, and at a certain depth, a p-n-junction was formed. Layers were removed from the end faces by etching. Then the surface of the end faces was tested for the type of conductivity, using termoprobes to determine depth of the position of the p-n-junction and of the concentrated carriers.

The dependence of the solubility limit of Be in Ge on temperature is insignificant. The dependence of the coefficient of diffusion of Be in Ge on temperature is determined by this equation:

$$D = 0.5 \exp (-2.5/RT) \text{ cm}^2/\text{sec}$$

(Source: Metallurgy, No. 7/8, Part A, 1961, p. 3)

NEW POSSIBILITIES OF IMPROVING THE STRENGTH OF METALS (CHINESE). Ke Tin-sui, reporting in Kexue tongbas, Nauch. vestn., Scientia, No. 18, 1960, states that he has studied methods for obtaining extra-high-strength materials from metal "whiskers" and the conditions for obtaining long whiskers in a large quantity. Possibilities of obtaining high-strength mixed metal whiskers, obtained by reduction with H_2 of a mixture of halogen salts, are described.

By reducing CuCl and $FeCl_2$ (wt ratio 1:1), high-strength rods up to 1 mm diameter are obtained. These show a laminar structure and consist of a finely dispersed mechanical mixture of Fe and Cu crystals.

The article also states that by using different resins in the form of substances for binding the metal whiskers (at a certain temperature and pressure), it is possible to obtain a material of high strength. (Source: Metallurgy, No. 7/8, Part A, 1961, p. 28)

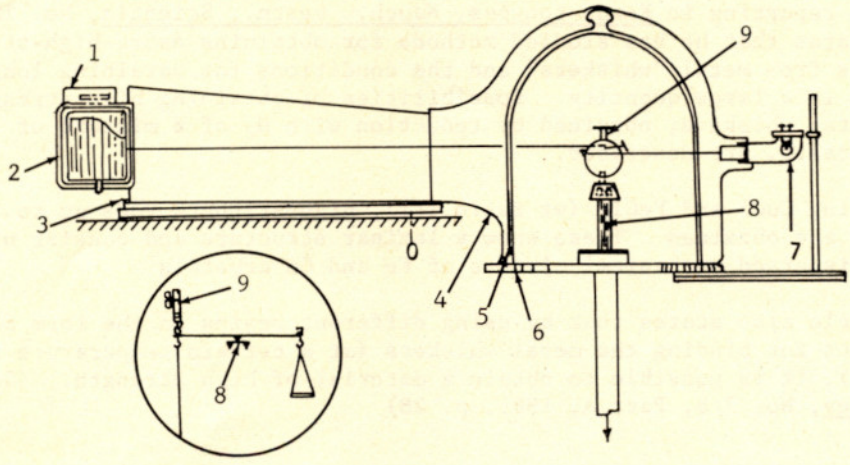
METALLURGY

WEIGHT CONTROL OF THERMAL PROCESSES. Figure 3 shows a laboratory scale designed by the Ural Polytechnic Institute for studying the composition of compounds (e.g., oxides) of nonferrous and rare metals in pyrometallurgical processes. The device, described in Zavodskaya Laboratoriya, Vol. 28, No. 2, 1962, makes it possible to determine the rates of dissociation, vaporization, sublimation, oxidation, and reduction, as well as other interaction processes connected with the liberation or binding of gaseous substances. Also, the fact that specimen temperature can be recorded makes it possible to combine gravimetric and thermographic studies.

Weight changes can be determined with an accuracy of 1 percent, and specimen temperature can be regulated in the 0° to 1300°C range with an accuracy of 0.5 percent. (Source: Dept. of Commerce, A.I.D. Press, No. 696, April 27, 1962, p. 3)

EFFECT OF NEUTRON BOMBARDMENT ON ELECTRICAL AND MAGNETIC PROPERTIES OF SOME ORDERING ALLOYS. M. A. Artsishevskii and Ya. P. Selisskii have investigated the effects of neutron bombardment of binary alloys similar in composition to commercial Mo-permalloy and 50N alloy. Their report, appearing in Fizika Metallov I Metallovedenie, 11, No. 1, 1961, identifies the tested alloys of the stoichiometric composition as Ni_3Fe, Ni_3Mn, Ni_3Cr, Fe_3Al, and $Ni_3(Fe,Mo)$.

Before irradiation, the alloys were brought into annealed, quenched, and workhardened states (methods of treatment are given). Neutron bombardment was carried out at 60°(C?) and integral fluxes of $5 \cdot 10^{16}$ and $5.5 \cdot 10^{17}$ neutron/cm^2, and at 350°(C?) with a flux of $4 \cdot 10^{18}$ neutron/cm^2.



1. Reducing gear; 2. Case; 3. Height-adjustment screw; 4. Lightproof cover; 5. Glass Ball; 6. Base; 7. Light; 8. Scale; 9. Ring-type indicator

FIG. 3

After cooling and holding in order to remove the residual radioactivity, the electrical resistance and the magnetic properties of the specimens were measured. It was established that the acceleration of diffusion, which is probably connected with the formation of an excess concentration of Frenkel defects and which is particularly noticeable at low temperatures, takes place in the process of irradiation. The acceleration of diffusion leads to a higher equilibrium state of the alloy. However, increase of the integral flux above $4 \cdot 10^{18}$ neutron/cm^2 may lead to a reverse phenomenon, i.e., to disordering of the alloy. Magnetic properties are more sensitive to irradiation than the electrical resistivity. (Source: Metallurgy, No. 7/8, Part A, 1961, p. 62)

PRODUCTION ENGINEERING

ELECTRON-BEAM WELDING GUNS. In the June issue of Automatic Welding, O. K. Nazarenko of the E. O. Paton Arc Welding Institute, Ukraine SSR Academy of Sciences, discusses two methods of electron welding now being used by the USSR.

He states that electron welding guns with combined focussing systems are now being used by many Soviet industries. The primary electrostatic electron-optical system in the gun forms the convergent beam of electrons; crossover is the object for one of several electromagnetic lenses, which projects its image onto the work. Electron guns which, at an accelerating voltage below the threshold of hard X-radiation (i.e. of the order of 20 kv), provide high-grade welded joints (with heat affected zones of minimum size and a satisfactory ratio between the depth and width of penetration) are of the greatest interest.

Specific primary electrostatic electron-optical systems and specific electromagnetic systems for use with them should be selected, in each particular case, with relation to the thickness of metal to be welded, the melting point of the metal, the required welding rate, and other factors.

The two electron-optical systems described and illustrated in this article work at an accelerating voltage of 20 to 22 kv.

In the "Conclusion" of this article the following remarks are made:

1. A spherical-type welding electron gun has been developed with which an acutely focussed beam of electrons can be formed at a voltage of 20 kv and a current of 100 ma. The diameter of the focal spot in the plane of the work is about 0.5 mm.

2. A welding electron gun with a conductivity of $\sim 1.1 \cdot 10^{-2}$ $A/kv^{3/2}$ has been devised. With this gun, an electron beam of about 20 kva, at a voltage of 20 kv, can be formed. The specific power of the beam in the welding plane is 6 to 8 kva/mm^2.

(Source: Automatic Welding, No. 6, June 1961, p. 28)

SPACECRAFT

COMPARISON OF VOSTOK AND MERCURY-REDSTONE. In a comparison of the power and weight parameters of the Gagarin flight with those of the Shepard and Grissom flights, it is stated in the April 11 edition of Pravda Ukrainy that the vehicle used to launch the American astronauts develops one-tenth the power of the Gagarin rocket. It is claimed that the American capsule weighs only one-fifth as much as the cabin used by Gagarin. (Source: Dept. of Commerce, A.I.D. Press, No. 696, April 27, 1962, p. 1)

DETAILS OF THE VOSTOK SPACECRAFT. The Soviet magazine Radio, No. 11, 1961, states that cosmonaut Titov landed near the village of Krasnyy Kut in Saratov Oblast after his flight. Following are some details of the magazine article concerning safety precautions provided in the Vostok.

"The special seat in which the cosmonaut rode is a complex apparatus which ensures the pilot the possibility of remaining in the cabin for a long time, and in case of necessity, safe separation from the ship and safe landing on the Earth.

"In case an emergency situation arises during launching or entry into orbit, there is a special device in the seat which automatically ensures the safe operation of separation of the cosmonaut from the ship and safe landing. The seat has an oxygen reserve and an air-conditioning system, a radio transmitter and receivers, and emergency supplies which can be used after landing.

"If the need arises for landing the cosmonaut separately from the ship, the seat's parachute system ensures its stabilized and smooth descent on land or water. In a water landing, the pilot can use an inflatable boat which unfolds automatically and is ready for use at the instant of landing.

"The special hermetically sealed space suit can support the cosmonaut lying on his back in the water. The suit will protect the wearer even in icy water with a temperature of 0° (C) for up to 12 hr without any ill effects." (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 16)

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

n.a., International Congress, First, Moscow, 1960. Proceedings: Automatic and Remote Control. 4 volumes. London: Butterworth and Co., Ltd. 1961.

Almost 300 papers were presented at this congress by delegates from various countries of the world. These four volumes contain the text of the papers read, together with discussions, forming a useful survey of the present state of the science of automatic control.

The first two volumes contain those papers concerned with theory and methods of calculation. Volume 3 covers electric and magnetic components, electrical simulation comptrolling components and governors, systems of remote and supervisory control; pneumatic components and computing devices; and automatic control instruments and devices. The last volume, dealing with applications, embraces automation in metalworking, of electric power stations, in transport, of industrial processes, in chemical and oil industries, of thermal and nuclear power, and of metallurgical processes. (Source: The Chartered Mechanical Engineer, April 1962, p. 243)

Schröder, Wolfgang, Der Sprung ins All (Leap into Space). Wiesbaden: Verlag G. A. Brockhaus. 1961.

A new book has come to join the serried ranks of works on popular science dealing with space. Mr. Schröder sets out the basic principles of space travel in layman terms. While no new views are put forward, a general and complete exposé of the problems is presented. (Source: Interavia, Vol. XVII, No. 4, 1962)

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

ASTRONOMY

Ivanikov, V. I., Possibility of Photographing Artificial Earth Satellites. July 11, 1958, 5 p. (61-15322/110).

Kurnosova, L. V. and others, Cosmic Radiation from the Sun. March 22, 1961, 6 p. 3 refs. (61-21488/050).

CHEMISTRY

Kaptsan, O. L. and Teplyakov, V. A., High Frequency Titration. May 1954, 12 p. 38 refs. (60-19921/240).

Menkovskiy, M. A. and Aleksandrova, A. N., An Accelerated Method for the Determination of Germanium in Ashes of Mineral Coal. 1960, 3 p. 3 refs. (61-13366/180).

Nikolayev, N. S., Buslayev, Yu. A., and Opalovskiy, A. A., Synthesis of Higher Fluorides of Niobium, Tantalum and Molybdenum with the Aid of Chlorine Trifluoride. October 13, 1960, 6 p. (1 fig. omitted) 11 refs. (61-15259/180).

EARTH SCIENCES

Tkachenko, A. V., On the Power of Convection and Its Utilization in Local Forecasting. June 22, 1959, 7 p. (10 equations omitted) (61-13562/180).

Bolyunova, A. D., A Contribution Towards the Construction of a Model of the Atmosphere. February 4, 1961, 14 p. 13 refs. (61-21168/050).

Burkard, O., Thermal Splitting of the Ionospheric Layers. April 1960, 5 p. 2 refs. (NRCC C-3464/050).

ENGINEERING

n.a., The Second Moon Rocket: (Selected Articles). September 1959, 13 p. (60-13857/240).

n.a., The Second Moon Rocket: Tass Reports. September 1959, 7 p. (60-13829/180).

n.a., The Third Cosmic Rocket: Repts. October 16, 1959, 8 p. (60-13858/180).

Petrovich, G. V., Spaceships in Earth Satellite Orbits. December 6, 1960, 14 p. (61-11584/050).

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Shibanov, A., Magnetic Engine and Magnetic Brake. October 11, 1960, 6 p. (61-15272/180).

Sobolev, (S.)P. (Shneydman, A. Ye.) and others, Development of the Last Stage Blading for a 150 Mw Turbine. 1960, 12 p. (61-13300/240).

Zavadovskiy, A. M., Relationships Characterizing the Output of a Turbine Stage. 1960, 11 p. (61-13212/240).

MATERIALS

Volkova, V. L., How to Inhibit the Ageing of Bitumen. October 1960, 7 p. (61-13907/180).

Kamenichnyy, M. S., Production of Ultra Light-Weight Refractories. November 1960, 3 p. (61-13919/180).

Chukhanov, Z. F., Problems in Theory of Combustion of Carbon and Coke and Trends in Development of Combustion and Gasification Technology of Solid Fuels. September 1960, 78 p. 5 refs. (61-13485/450).

MATHEMATICS

n.a., Information Processing Machines, Vol. III. October 1959, 480 p. 58 refs. (60-15504/2350).

Braines, S. N., A Computer Capable of Learning. March 1, 1961, 6 p. (61-19539/110).

MECHANICS

Litvin-Sedoy, M. Z., On the Mechanics of Controlling Angular Motion of a Body by Means of Rotors. May 15, 1961, 18 p. 5 refs. (61-23055/160).

Pomerantsev, A. A., Wall Heating by a Supersonic Gas Flow. February 28, 1961, 11 p. 3 refs. (61-31101/050).

METALLURGY

n.a., Production and Physical Metallurgy of Pure Metals, Pt. 8. August 12, 1960, 42 p. 26 refs. (60-41090/125).

Bazilevskiy, A. R. and others, New Technique of Deoxidizing Steel with Aluminum. October 1960. (HB-5015/300).

Kornilov, I. I. and Polyakova, R. S., Investigation of the Heat Resistance of Alloys of Platinum with Rhodium, Iridium, Ruthenium, Chromium, and Aluminum by the Bend-Test Method. September 15, 1960, 9 p. 26 refs. (60-41356/050).

NUCLEAR PHYSICS AND CHEMISTRY

n.a., Soviet Nuclear Instrumentation and Control for Propulsion. February 1, 1961, 12 p. 7 refs. (61-19118/240).

Carpovich, Eugene A., Russian-English Atomic Dictionary, 2D Ed. Rev. 1959, Order from Technical Dictionaries Co., Box 144, New York 31, N. Y. $12.00

n.a., All-Union Conference on the Introduction of Radioactive Isotopes and Nuclear Radiation into the National Economy of the USSR: Selected Articles. February 24, 1961, 58 p. (61-21246/175).

PHYSICS

Garbell, Maurice, A., Soviet Research on Gravitation: An Analysis of Published Literature (and) The Problem of the Physical Nature of Gravity. October 1960, 379 p. (61-15019/1110).

Pactz, K., Preparation of Very Pure Silicon. January 11, 1960, 9 p. (1 fig. omitted) 4 refs. (61-15039/180).

RESEARCH METHODS AND EQUIPMENT

Dietrich, W., Development of a Character-Reading Device for Typewritten Figures. 1961, 8 p. (4 figs. omitted) 6 refs. (61-10888/110).

Sobolev, S. and Polykovskiy, A. M., A Machine Reads Forgotten Script (and) New Method of Speech Spectrum Synthesis. March 29, 1961, 15 p. 2 refs. (61-21410/050).

n.a., Soviet Scientists: Selected Biographies. April 3, 1961, 31 p. 42 refs. (61-21736/100).