

Space INTELLIGENCE NOTES

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

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FROM THE WORLD PRESS

SOVIET MILITARY PRODS SPACE-WAR PREPARATIONS. Top Soviet military strategists recently published a recommendation that Russia prepare for war in outer space.

Such steps, the military leaders argued, are essential to meet alleged American attempts to turn the cosmos into a theater of war.

The suggestion appeared in a review of a new textbook on strategy written by the Soviet Union's top military leaders. The review was published by the Soviet military newspaper Red Star.

The review, by Army Gen. Pavel Kurochkin, said one of the text's chapters was devoted to the use of outer space for military purposes. He said authors had introduced a number of facts showing that the U. S. is already engaged in such activity.

"The Soviet people are engaged in the peaceful conquest of space," the review said. "But it is perfectly clear that if the imperialists continue to conduct research for means of using cosmic space for military goals, then the interests of guaranteeing the security of the Soviet state demand definite measures from our side."

The textbook, written under the direction of Marshal V. D. Sokolovsky, was said to be the first serious work on military strategy published in Russia since 1926.

Other points discussed in the review included:

1. The strategists' demand for larger ground forces than ever before for atomic-age warfare. This appeared to differ from American strategic concepts calling for smaller and highly mobile tactical units.
2. All-out nuclear strikes against the enemy homeland, including government and industrial centers. This appeared to run counter to some Western strategists' theories that the Soviets might confine themselves to attacks on purely military objectives.

While the article mentioned defense of Soviet rear areas against nuclear strikes, it made no reference to Premier Khrushchev's claim that the Soviets have rockets that will "hit a fly in outer space."

The reviewer criticized the authors of the text for devoting too little attention to the strategic role of ground troops. He also rebuked the authors for "fleetingly and superficially" treating the guiding role of the communist party in military affairs. (Source: Washington Post, September 23, 1962)

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SIX SOVIET SPACE FAILURES DISCLOSED. James Webb, NASA Administrator, disclosed that the USSR had made six unsuccessful attempts to send instrumented space probes to Mars or Venus.

"Appropriate government agencies" furnished information on four failures which were never announced and one which was passed off as a successful orbital shot.

The US announcement said the Soviets used three booster stages to achieve orbit on their shots and a fourth for ejection into trajectory.

The list of Soviet failures are:

- October 10, 1960 - Unannounced Mars probe attempt.
- October 14, 1960 - Second unannounced Mars probe attempt failed to achieve orbit.
- February 4, 1961 - Venus probe was placed in orbit but failed to eject. Claimed to be successful orbit of Sputnik 7.
- February 12, 1961 - Announced Venus probe achieved interplanetary trajectory, but its radio transmitter failed at 4.5 million miles.
- August 25, 1962 - Third attempt at a Venus probe failed to eject from orbit.
- September 1, 1962 - Fourth attempt to reach Venus failed when it did not eject successfully from its parking orbit.

(Source: Missiles and Rockets, September 10, 1962)

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INDIA OFFERS SPACE PROBE SITES TO UNITED NATIONS. India recently offered to provide equatorial bases for an international rocket probe of outer space. This offer was the first concrete step toward implementing scientific programs at the current session of the U.N. Committee on Peaceful Uses of Outer Space.

India's offer to be host for the rocket research project is related to a proposal that 1964 be set aside as the International Year of the Quiet Sun. Solar interference will be at a minimum that year. Part of the research recommended will be done with sounding rockets gathering data above the Earth's equator.

The southern part of India lies within 10 deg of the equator and presumably would be an ideal launch point for the project. (Source: The Los Angeles Times, September 13, 1962)

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U.S. AND ITALY PLAN JOINT SPACE PROGRAM. On September 5 of this year, Vice President Johnson and Foreign Minister Attilio Piccioni of Italy signed and exchanged notes confirming a joint U.S.-Italian cooperative program for the peaceful exploration of space. This agreement provides for a three-phase plan, which is expected to culminate in the launching of a scientific satellite into equatorial orbit. It is anticipated that the launch will be from a towable platform in equatorial waters.

The objective of the program is to obtain high-altitude measurements of atmospheric and ionospheric characteristics. Data collected will be made available to the world community of scientists.

According to agreements, NASA will provide four-stage Scout rockets and training, while the Italians will actually launch the vehicles, provide payloads, and be responsible for data acquisition as well as the towable platform.

The projected program, designated Project San Marco, consists of these three phases:

1. Sounding rocket launches to provide test flights of the principal elements of the scientific payload.
2. A prototype satellite payload will be placed in orbit by means of a Scout vehicle launched from Wallops Island.
3. A scientific satellite will be placed in an equatorial orbit by means of a Scout vehicle launched from the platform.

(Source: The Eastern Shore News, September 13, 1962)

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JAPAN SELLS ROCKETS ON WORLD MARKET. Japan, long known for its beautiful fireworks, is now in the rocket export business. Mitsui Bussan, one of the world's leading trading companies, will send prospective buyers, on request, a special brochure entitled "Kappa 6H Sounding Rocket."

Japan has sold its rockets to Yugoslavia, and there have been inquiries from Argentina, Brazil, Spain, Australia, and Canada. For a time, there were even hopes of sales to the U.S., but much to Mitsui's regret, NASA is primarily interested in buying instrumentations.

Because the Kappa uses solid fuel and has a simple overall design, it can carry out space and meteorological missions up to altitudes of 65 miles. Only a minimum ground crew is required.

Japan hopes to have a monkey in space by 1964. To date, Dr. Hideo Itokawa, Japan's foremost rocket expert and designer, has already launched 25 sounding rockets. Included in these was one "rockoon"--a rocket fired from a balloon.

The latest rocket carried a payload of 88 lb to an altitude of 220 miles: Soon, Dr. Itokawa expects to have rockets going up to 650 miles with 220-lb payloads. (Source: Washington Daily News, September 5, 1962)

ASTRONOMER BELIEVES MOON PROGRAMS UNREALISTIC. Dr. Armand Spitz, founder of the Smithsonian Institute's "Moonwatch team," says that neither Russia nor the United States will be able to land a man on the Moon and bring him back safely during the next 10 years.

Dr. Spitz told the National Astronomical League that radioactive outbursts from the Sun may rule out lunar flights for several years. This does not rule out the possibility of "flashing a man over the landscape" of the Moon, but to "have him land there, make good scientific observations, communicate his findings, and come back successfully to tell us about it" might prove fatal. (Source: Special Press News Release, Greater Albuquerque, New Mexico, Chamber of Commerce, September 1962)

GERMAN SPACE AIDE A MANY-TITLED MAN. When it comes to titles, Mr. Leo Brandt, a new member of the West German Space Commission, has a most distinguished appellation. He is properly addressed as State Secretary Professor Doctor Engineer Leo Brandt. According to German custom, his wife should be addressed as Frau State Secretary Professor Doctor Engineer Brandt. (Source: Washington Star, September 7, 1962)

SOVIETS URGED TO REVEAL SPACE DATA. The 13th International Astronautical Congress opened September 24 in Varna, Bulgaria with Western pleas that the Russians remove the "seven veils" of secrecy from their space program.

"We are all aware of the security problem," said Swedish space medicine specialist Dr. Ake Hjerstrand. "Yet the Russians have seven veils where the West has one."

Dr. Hjerstrand's appeal, echoed by American scientists here, set the stage for the first space congress to be held on communist soil.

In the past the Soviets have given little fresh or exciting information on their space program--although they used the congress' platform in Washington, D. C., last year to reveal that cosmonaut Gherman Titov was affected by space sickness.

Raymond W. Hallet Jr., 41, of Pacific Palistades, Calif., the chief nuclear engineer for Douglas Aircraft's missile and space systems division, urged the Russians to tell about their progress toward a rendezvous of two orbiting spaceships.

This, Mr. Hallet said, was "a problem they seem to have come close to solving when they orbited their two Vostoks at once." He also called on Russia to tell what kind of vehicle it will use for its first manned trip to the Moon.

"The United States announced its lunar program weeks ago," he said.

A Washington space lawyer warned that the Kremlin may be plotting a claim on outer space.

Andrew G. Haley, chairman of the Fifth Colloquium on the Law of Outer Space, said Premier Khrushchev once agreed that no nation could claim outer space or the planets as its own.

But recent Pravda and Izvestia articles, Mr. Haley said, indicate the Russians are "changing their tune."

If the Soviets did claim sovereignty over the Moon and tried to tell other nations to keep off, he said, it "would almost certainly lead to war." (Source: Washington Daily News, September 24, 1962)

USSR TO TRY SUN DATA SHOTS. Russia plans to build special rockets and unmanned satellites in connection with the worldwide "International Year of the Quiet Sun" activities to obtain more information about the Sun. (Source: Missiles and Rockets, September 10, 1962)

COSMONAUTS DESCRIBE FIERY PLUNGE AT ORBIT'S END. A recent news item in Pravda reports on the comments to Andrian Nikolayev and Pavel Popovich concerning their return to Earth from orbit. They stated that their spaceships were like balls of fire during reentry. The experience was "a little bit frightening...probably one of the most tremendous impressions in life."

"Our antennas charred, the (radio) connection between the Earth and the spaceships stopped. We did not close shields over the portholes, but from behind the heat-proof glass, watched with curiosity as flames raged in different colors, alternating from blue to dark red.

"We knew it had to happen, but still it was a little bit frightening to be in the center of the fireball, the heat of which rose to several thousand degrees....

"The stresses (on us) during descent seemed a bit stronger than during the launching into orbit. Tremendous weight pressed us against our chairs. Air streams hit the shields of the spaceships, making them vibrate. You had the impression of speeding in a cart without springs on a bumpy road." (Source: Chicago Tribune, September 1, 1962)

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USSR INSISTENT ON A SPACE CODE. At a meeting of the United Nations Committee on the Peaceful Uses of Outer Space on September 10, the Soviet Union made strong demands for consideration of a report on legal pacts before considering a report on international cooperation. Soviet representative P. D. Morozov stated that international cooperation in the use of space would be impossible without agreement on the basic legal principles governing its use. The issue was raised again as the legal subcommittee had failed to reach agreement last summer in Geneva.

After agreement on legal aspects, Mr. Morozov said the Committee should then consider the recommendations of its scientific and technical subcommittee, the U. S. high-altitude nuclear tests, and disarmament, because all of these will have an influence on international space cooperation. Mr. Morozov managed to take the floor to present Soviet demands before the chairman, Dr. Franz Matsch of Austria, could deliver his opening statement.

Although there was strong opposition to changing the order fixed by the agenda, Mr. Morozov offered a procedural compromise. Under this plan the Committee would take up the reports on basic space legal principles and international space cooperation jointly.

The Committee finally agreed without a vote to start the session with a general debate. Each of the 28 members will have the right to discuss any aspect of the Committee's work, then proceed with consideration of the two reports.

After this was decided, Mr. Morozov reintroduced two Soviet proposals that were not accepted by the legal subcommittee:

1. International agreement on rescue of astronauts and spaceships making emergency landings.
2. Basic principles governing exploration and use of space, including prohibition of the use of satellites for "intelligence objectives" and a ban on the use of space for "propagating war."

(Source: New York Times, September 10, 1962)

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BRITAIN REPORTEDLY TESTING SPACE-FIGHTER AIRPLANE. Britain is reported to be testing models of an 18,000 mph "space fighter" that takes off like an ordinary airplane but can power into orbit and back again. This craft, which has the capability of operating in the atmosphere or in space, could be operational by 1970 according to Julian Amery, Minister of Aviation.

Models of the plane have been tested successfully in wind tunnel facilities at the Royal aircraft establishment near Bedford, England. This new craft, which might cost some \$280 million to develop, could soar 500 miles above the Earth, three times as high as most manned space flights so far. It would use folding wings that tuck back into the fuselage while the craft was in orbit and a ram-jet that could be packed into a very small canister.

The space fighter is based on the concept of "sustained flight" rather than the "boost-glide" principle of Dyna-Soar. (Source: Washington Post, September 7, 1962)

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MOON ENVISIONED AS POWER SOURCE. Two imaginative ideas aimed at permitting men to make the Moon an economic asset and thus repay the cost of reaching that satellite have been advanced by the Soviet Union's first Nobel Prize winner, Academician Nikolai N. Semenov.

Academician Semenov, who received his Nobel Prize in chemistry, put forth his ideas in a speech printed September 12 in Komsomolskaya Pravda, the Communist Youth League newspaper.

Realization of either idea would first require major advances in the technology of power transmission. The presentation of such ideas publicly is in accord with the Soviet belief that if advanced scientific goals are made known, an important start is made toward getting many scientists thinking about these goals and about how to achieve them.

Both of Academician Semenov's ideas involve making the Moon a major source of power production for human needs on Earth. He suggests that research may find ways to transmit such power economically to Earth by means of directed radio beams, perhaps based on high frequency waves.

He points out that the recently discovered lasers and masers are now able to transmit small quantities of light and microwave energy, and suggests that these instruments may be vastly improved in the future.

Maser stands for microwave amplification by stimulated emission of radiation. Laser stands for light amplification by stimulated emission of radiation. A laser is often called an optical maser.

One of Academician Semenov's ideas for making the Moon a powerplant for the Earth is based on the fact that the Moon's surface receives about one-fifth as much solar energy as does the Earth's surface. He suggests covering the Moon with semiconductors and photoelements of high efficiency.

This, he suggests, would permit the solar energy falling on the Moon to be converted to an electricity production capacity of several score trillion kilowatts, a capacity far greater than the total capacity of all electric power stations now in existence on Earth.

Academician Semenov's other proposal is that the Moon be made the site for all atomic and thermonuclear power stations. This would have two advantages, he declares.

One would be to safeguard the Earth from radioactive contamination resulting from the operation of these nuclear power stations.

The other would be to avoid overheating the Earth during the production of power. Academician Semenov argues that when controlled thermonuclear power becomes a reality, the total of such power actually generated on Earth will have to be limited to 5 or 10 percent of the total solar energy falling on the Earth in order to avoid overheating the Earth and its atmosphere.

For a more distant future, Academician Semenov argues that when mankind has an unlimited amount of energy at its disposal, it may be possible to make Mars habitable by using vast amounts of energy to extract oxygen from water and rocks on Mars, thus giving that planet the life-supporting atmosphere it is now believed to lack. (Source: New York Times, September 23, 1962)

THE LAUNCHING OF COSMOS 8. The following information was taken from Izvestia, August 25, 1962, and is the most detailed report to appear in the Soviet press concerning Cosmos 8.

Soon after the successful flights by the hero-astronauts Nikolayev and Popovich, the Soviet Union injected into orbit a new artificial Earth satellite--"Cosmos 8". A correspondent of Izvestia has asked the senior scientific associate of the Soviet Academy of Sciences, T. Nazarova, to explain the mission of Cosmos 8. Following is her statement:

"The launching of Cosmos 8 is a continuation of the program for cosmic space research which began with the launching of Cosmos 1 in March of this year.

"Among the scientific experiments which are provided by the program, this spacecraft is conducting measurements of the density of meteoric matter at the fringes of the Earth's atmosphere, at altitudes from 250 to 600 km. This type of research is important for the purpose of accurate evaluation of meteoric dangers which spaceships will encounter at these altitudes. The investigations are of great interest to geophysics, astronomy, and to scientists who are engaged in the study of the origin and evolution of planets in the solar system.

"It should be said that the study of meteoric matter with the help of rockets and satellites has been conducted by the Soviet Union and the United States of America for the past several years. Scientists anticipate with great interest the results of new experiments. The point is that the study of meteoric dangers in the near-Earth space regions requires the conduction of systematic investigations. While travelling in orbit around the Sun, the Earth passes through zones with various

densities of meteoric matter. In this case I do not talk about the fact that during its journey through the universe our planet encounters meteoric fluxes where this density might be many times larger than in normal conditions. Thus the density of meteoric matter changes in time and space. It is therefore necessary to conduct regular experimental investigations of the dust content of space.

"For the purpose of measuring the density of meteoric matter, the satellite Cosmos 8 is equipped with piezo-electric detectors. These detectors are fastened to a specific section of the satellite's body. When the outer surface of the satellite is impacted by micro-meteoritic particles, the piezo crystal becomes deformed and emits an electrical impulse. This impulse is amplified by instruments aboard the satellite and transmitted over the telemetry systems to Earth. Knowing the frequency of impact of micro-meteorite particles, the area of the satellite's surface over which the impacts are registered and also the velocity of the satellite as well as a number of other data, it is possible to determine accurately the density of meteoric matter.

"This is the seventh day that the satellite is orbiting the Earth. It should be said that all its instruments are operating faultlessly. We receive every day scientific information from aboard Cosmos 8. A great amount of material should be accumulated in order to reach reliable conclusions on this experiment. It is therefore too early to make any statements on the results which were obtained with the help of the satellite.

"I can make only one statement: Cosmos 8 is operating in an excellent manner." (Source: Russian News Brief, Electro-Optical Systems, Inc., September 11, 1962)

SOVIET COMSAT PLANS. Alexander Kakunin, USSR Vice Minister of Communications, stated recently that his country plans to put communication satellites into synchronous orbit.

In an article appearing in Gazeta Pomorska, a Soviet commentator says the future "cosmotelevision center" will beam television programs to the satellites from 11 a.m. to 3 p.m. and from 11 p.m. to 3 a.m., and it will receive other satellite programs between those periods. No further details were provided.

The launching dates for the satellites were not given. "It should happen in the very near future, according to Prof. K. Sergeyev, an excellent forecaster of space events," states Gazeta Pomorska. (Source: Aviation Week and Space Technology, September 24, 1962, p. 40)

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SOURCES OF USSR MOLYBDENUM. Proizvodstvo molibdata kal'tsiya. Alma-Ata, Izd-vo AN Kaz SSR indicated in a recent issue that approximately 40 percent of the yearly Soviet molybdenum production comes from complex poly-metallic ores. Copper-molybdenum ores supply 50 percent of this amount and tungsten-molybdenum ores 25 percent. Lead-molybdenum, vanadium-molybdenum, and similar ores supply the remainder. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 796, September 17, 1962, p. 8)

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REPORT FROM BEHIND THE SOVIET SPACE CURTAIN. (This note is based on an article appearing in the September 1962 issue of Space World. The editors of Space World state, "We have seen full documented proof, corroborated by U.S. Congressmen and Central Intelligence Agency (CIA) officials, that each of the Kilsoo Haan predictions was sent to Washington in advance--but never acted upon.") The world's only "private" espionage system, whose tips on international intrigues have been uncannily accurate for 25 years, has recently submitted a disturbing report to the Central Intelligence Agency on Soviet space progress. This report states that the USSR has developed nuclear rockets, an area in which the U.S. considers itself comfortably in the lead.

Called the Sino-Korean People's League, this remarkable band of volunteer spies is totally loyal to the Free World. Their leader is Kilsoo K. Haan, a Korean who became an American citizen in his youth and is now the sales manager for an unidentified import firm.

The People's League began its activities in 1932 by undermining Japanese war plans for invasion of the Asian mainland. After the rise of Red China, Mr. Haan's organization outperformed the ace intelligence agencies of world powers. The Chinese communists were perfectly scrutible to this clever crew who penetrated the Bamboo Curtain with ease to gather valuable information.

CIA respects the League's reports for a good reason--on Wednesday, December 3, 1941, a message from Mr. Haan warned that Japan planned a secret attack on Pearl Harbor the next Sunday, December 7. Unfortunately, the message was ignored.

Other reports that have since become grim history include:

- 1946 - A warning that with Soviet help, the Chinese communists planned to drive out Chaing Kai-Chek by 1950.
- 1949 - Year-long warnings that South Korea would be attacked in 1950.
- 1949 - Prediction of Russia's first atom bomb test months prior to President Truman's announcement of September 23.
- 1949 - Warned of Chinese communist plans in Laos and Vietnam long before they moved in.
- 1954 - Released the "hilarious" report that Russia had laid out a serious space program in which the first satellite would surprise the world in 1957-1958.

1961 - Predicted the moratorium-breaking Soviet nuclear tests, stating they would demonstrate super-bombs of 50 to 75 megatons.

A prediction of 1958 hasn't come true yet. Mr. Haan sent President Eisenhower strong evidence that "Russia is planning a nuclear-powered space platform as its ultimate weapon...to force the liquidation of U.S. military bases surrounding the USSR and China." Then, to President Kennedy on September 9, 1961: "Russia now has a rocket booster that can orbit a 12-ton spaceship. Soviet scientists and engineers have begun building the first nuclear-powered space platform...to be manned by three cosmonauts."

The latest Haan report came on May 22, 1962: "Soviet outer space scientists and engineers have successfully developed two powerful nuclear rockets...for the space platform and outer space armed spacecraft. The nuclear rockets are to be ready for tests in the spring of 1963." U.S. nuclear rockets being built for Project Rover won't be ready according to NASA until 1967 at the earliest.

Since 1941, Mr. Haan's Spy League has prognosticated many events that have come to pass. Today in 1962, his chilling report states: "The Sino-Soviet powers will be ready for a showdown, a Pearl Harbor of space, between 1964-1965." (Source: Space World, September 1962, p. 5)

TITOV'S SICKNESS EXTENSIVE. Although Soviet Major Gherman Titov has claimed repeatedly that he suffered no undue stresses during his orbital flight, Soviet scientists disagree.

A. A. Blagonravov, of the Soviet Academy of Sciences, said, in a report given at the COSPAR meeting, "The sensation of discomfort accompanied a significant portion of the flight. Titov's unpleasant sensations of the vestibular character were felt progressively, especially when the space pilot turned his head or observed fast moving objects. After sleep, these phenomena decreased, but were felt up to the beginning of reentry."

Dr. V. V. Parin, academician of biomedical sciences of the National Academy of Science, Moscow, told U.S. space scientists in Los Angeles that symptoms of dizziness, nausea, and nervousness began during the sixth orbit and became increasingly worse until the seventh orbit. Titov managed to go to sleep and remained asleep for 8 hr. After awaking, he felt better.

Professor Vladimir I. Yazdovskiy gave the first indication that the Soviet flight was not all roses. He reported that Titov suffered "unpleasant sensations." (Source: Space Technology International, July 1962, p. 28)

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LUNAR ATMOSPHERE CREATION. V. A. Bronshten of the Moscow Planetarium states that it is virtually impossible to create an artificial lunar atmosphere because its mass would only be 0.4 of the Earth's atmosphere. Lunar gravity is only one-sixth of the Earth's.

Even if such an atmosphere were created, it would soon be lost into space. The best to be hoped for is the creation of special rooms or caves with an artificial atmosphere. These could be inhabited by workers at lunar stations. (Source: Soviet Bloc Research in Geophysics AST, August 31, 1962, p. 1)

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SPACE THREAT CHARTED. North American Air Defense Command's Space Detection and Tracking System delineated a potential space threat to the continent as Soviet cosmonauts Nikolayev and Popovich made their crossings over Canada and the United States (see Fig. 1). Had they carried launchable warheads, they could have zeroed in on any point in either nation.

Even since Russian Maj. Gherman Titov's 17 Earth orbits August 6, 1961--followed immediately by then NORAD Commander in Chief Gen. L. S. Kuter's statement, "We are now in the era of a requirement for an antisatellite satellite, something which can deal with an armed enemy satellite"--the command's combat operations center has charted the increasing concern with the space threat.

Following his flight, Nikolayev told the press, "Vostok 3 carried no nuclear weapons and there is no need for such things, but, if need be, we have missiles which are splendidly capable of delivering nuclear warheads at any point," Reasons for military attention to the problem have their validation in this table:

<u>Cosmonaut</u>	<u>Origin</u>	<u>Spacecraft</u>	<u>Earth Orbits</u>	<u>Times over North America</u>
Titov	USSR	Vostok 2	17	10 (Aug. 6, 1961)
Nikolayev	USSR	Vostok 3	64-plus	40 (Aug. 11-14, 1962)
Popovich	USSR	Vostok 4	48-plus	30 (Aug. 12-14, 1962)

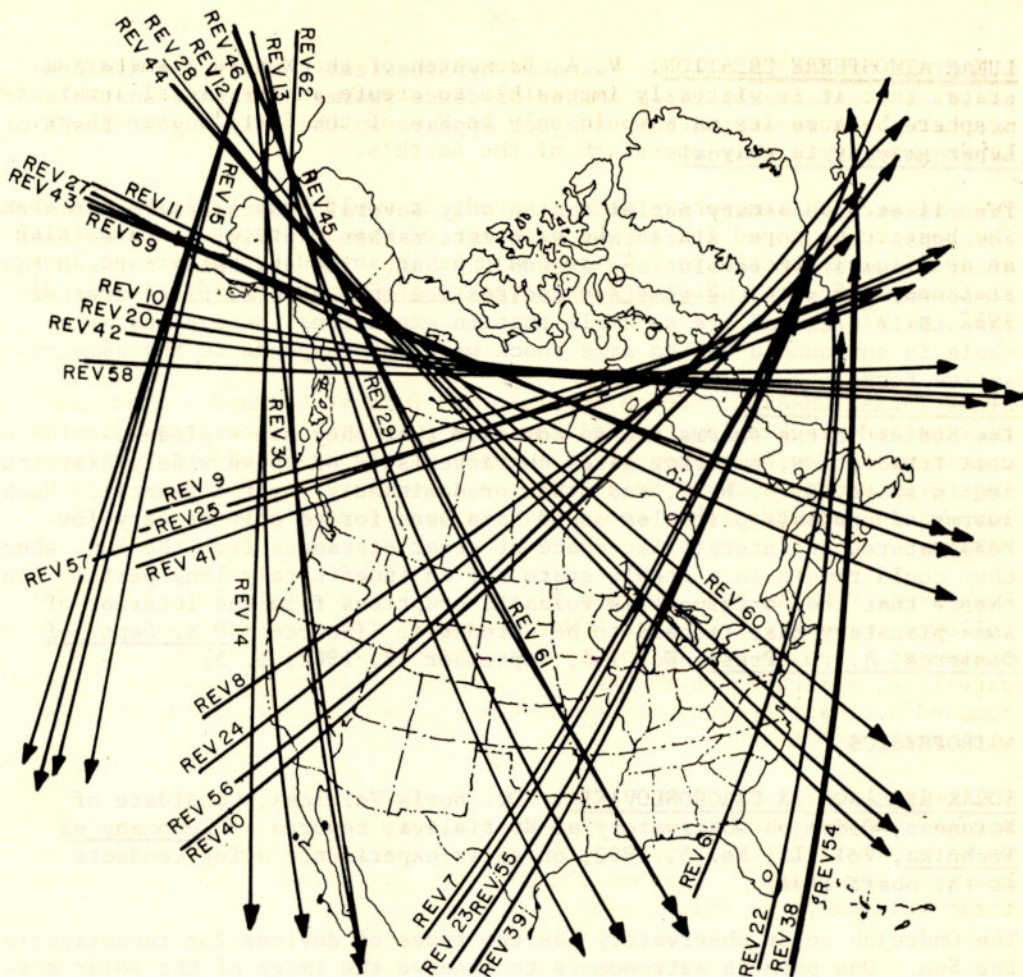
(Source: NORAD News Service Release, No. 38, August 31, 1962)

FROM THE TECHNICAL LITERATURE

ASTRONOMY

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VENUSIAN ATMOSPHERE. The Soviet physicist G. V. Rozenberg asserts that present concepts as to the nature of the Venusian atmosphere are incorrect owing to failure to take into consideration the absorption of solar



PATHS OF THE SOVIET VOSTOK 3 AND 4
ACROSS THE NORTH AMERICAN CONTINENT

FIG. 1

light in the planet's atmosphere. The solar light is subjected to various changes before leaving the planet. On the basis of his calculations he concludes that Venusian clouds are dry and the atmosphere has very little water and carbon dioxide.

Mr. Rozenberg's comments were made public in the August 28, 1962, issue of Zarya Vostoka. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 796, September 17, 1962, p. 9)

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STRUCTURE OF COMETS. V. G. Fesenkov hypothesizes that comets are composed of a relatively large number of dense swarms of rather unstable particles. A report on this subject appears in the July-August issue of Astronomicheskiy zhurnal.

The masses of cometary nuclei can be only several orders greater than the envelopes they form since they evaporate rather rapidly, as is evident after a number of revolutions around the Sun. The distances between the component parts in the cometary nucleus are only several times greater than their size and are so small that in explosions the nucleus as a whole is surrounded by the same shock wave and responds to the same reactive force.

The bodies in the swarms are so composed that they may explode even under weak irradiation, emitting gases characteristic of those widely distributed in space (H, C, N, O, and other predominantly light elements). Such swarms of unstable particles could have been formed only at very low temperatures in interstellar space at great distances from the Sun, where they could remain in a stable state for an indefinitely long period. The theory that they originate as volcanic eruptions from the interior of some planetary mass is held to be untenable. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 798, September 19, 1962, p. 5)

56

ASTROPHYSICS

SOLAR RESEARCH IN CZECHOSLOVAKIA. Dr. Boris Valnicek, Candidate of Sciences, Ondrejov Observatory at Bratislava, reports in Tudomány es Technika, Vol. IX, No. 5, 1962, on solar experiments being conducted at the observatory.

The Ondrejov solar observatory has two types of devices for investigating the Sun. One permits astronomers to observe the image of the solar surface directly, in white or in a particular spectrum, in a monochromatic light. The other type enables them to investigate the composition of and changes in the Sun, as well as the physical conditions prevailing on it.

The outer layer of the Sun is observed, in a white light, through an ordinary telescope with photographic attachments. Two photographs of the photosphere are taken daily. Changes going on in the Sun are observed through an interference filter in the hydrogen spectrum. When the solar disk is covered, the observatory prepares coronagrams. There is also a radio telescope used to supplement visual observation.

Extensive use is made at the observatory of spectrographs to analyze solar composition and to determine temperatures at which prominences and eruptions occur. From the deformation of the lines representing the elements, scientists determine the velocity at which matter moves in any

particular place and the nature of the electric and magnetic fields. The observatory has three spectrographs in operation and is now assembling a fourth.

Work began at the observatory 10 years ago. The most important achievement to date is a large solar spectrograph, reported as the most modern in the world. This instrument permits simultaneous photography of large-dispersion spectra in all seven ranges. The entire spectrum is about 5 m long. The instrument is automated to such an extent that only exposure time and the interval between exposures need be set. A new approach to the analysis of solar events is claimed possible by use of photographs taken by this device.

Several good-quality photographs are contained in the source. Included are photographs showing films of chromospheric eruptions, solar light duration register, radio telescope, and coelostat which channels sunlight to the spectrograph. (Source: Joint Publications Research Service, OTS 61-11147-42, August 31, 1962, p. 2)

~~46~~
X-RAYS STUDIED DURING PROTON FLARES. A. S. Dvoryashin, L. S. Levitskiy, and A. K. Pankratov stated in Astronomicheskiy zhurnal that scientists at the Crimean Astrophysical Observatory have detected a definite increase in the intensity of x-radiation during proton flares. Flare emission in H_{α} is observed to begin before intensity of x-radiation or radio bursts at centimeter wavelengths increases.

On the assumption that proton flares cause extra ionization of the ionosphere at heights of 60 to 70 km, it is concluded that super-hard protons with an energy of ~ 0.1 Mev are generated. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 784, August 31, 1962, p. 6)

~~48~~
IS SPACE COLD? Yu. Moralevich, in an article appearing in Zarya Vostoka said, "The myth of the extreme coldness of the interplanetary space, estimated variously at minus 180°C to below minus 220°C, was exploded by the data obtained during the flight of the third Soviet space rocket and other space investigations. The space vacuum is an excellent insulator, similarly to the vacuum in a vacuum bottle, and the rate of heat loss through infrared radiations depends solely on the characteristics of the surface of the body in space.

It is possible that future space suits and space cabins will dispense with any special cooling and heating apparatus and will use instead mirror-like reflecting and black heat-absorbing surfaces, which will be turned towards the Sun or towards the darkness of the space, depending upon whether heating or cooling is required." (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 776, August 21, 1962, p. 6)

23

METEORS AS ROCKET MODELS. V. Bronshteyn, writing in Kommunist, August 24, 1962, discusses the motion of nonmetallic meteors in the atmosphere. He notes that the flight of such meteors is of interest because of their resemblance to the flight of spaceships.

At a recent conference on meteors, he and Soviet scientists K. Stanyukovich and G. Pokrovskiy presented reports on results in the development of the theory of meteor flight in the atmosphere, where appreciable resistance is met at an altitude of 80 to 100 km. Describing the generation of plasma in front of the meteor, Bronshteyn states that the study of plasma under natural conditions has considerable scientific and practical significance, specifically for the solution of the problem of controlling thermonuclear reactions. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 792, September 12, 1962, p. 4)

28

PLANETARY RADIATION BELTS. On the basis of the hypothesis that a planetary magnetic field is related to the presence of a condensed core, Professor G. I. Pokrovskiy has computed the probable sizes of radiation belts around the planets of the solar system. He reports on his ideas in Priroda, No. 8, August 1962.

The minimum planetary radius required to form a condensed core is taken to be 6000 km. The larger a planet's radius, the larger are its core and radiation belts. When the radius of the planet is 24,000 km, the core radius is close to that of the planet; the magma layer is very thin, and the radiation belts occupy large spaces around the planet.

The Earth and Venus are near the minimum size. The former is surrounded by radiation belts, but the existence of Venusian radiation belts is yet to be determined. The Moon, Mercury, and Mars have no radiation belts or magnetic fields. They cannot have condensed cores because of their small size. Jupiter, Saturn, Uranus, and Neptune, however, must be considered bodies of "limited accessibility" to space travel. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 798, September 19, 1962, p. 5)

BIOSCIENCES

4

EFFECTS OF ANOXIA AND G FORCES ON DOGS. N. A. Agadzhanyan and A. R. Mansurov write in Byulleten' eksperimental'noy biologii i meditsiny, Vol. 53, No. 4, 1962, of a study which has been made of the respiratory and cardiac conditioned-reflex reactions of 20 dogs to anoxia at altitudes of 2000 to 10,000 m, and of the effect of prolonged radial accelerations.

Up to 4 G, the effects of moderate anoxia were counteracted by the dog's protective mechanisms. At accelerations of 5 G or more with acute anoxia at altitudes above 7000 m, functional disorders developed, and profound circulatory disturbances affected the functioning of the central nervous system.

X-ray pictures of the thoracic organs revealed that accelerations caused a change in the outline of the lungs and a decrease in the size of the heart and in the intensity of its shadow. In narcotized dogs, the decrease was greater at accelerations of 2 to 4 G than at 6 to 8 G, while in dogs which had not been narcotized the changes occurred at accelerations of not less than 6 G. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 787, September 6, 1962, p. 1)

THE EFFECT OF TEMPERATURE ON DECOMPRESSION SICKNESS. Pathologic physiology and experimental therapy, Vol. 6, No. 3, 1962, contained a lengthy report on decompression sickness. It gives the results of four series of experiments totaling 171 tests on 7 dogs and 33 tests on 624 albino mice. The purpose was to determine the effect of low environmental temperature--4° to 9°C--before, during, and after compression on the frequency of incidence and the severity of decompression sickness.

Cooling the dogs while they were under pressures of 2.4 to 3 atm for up to 4 hr considerably decreased the incidence and severity of decompression sickness. Cooling the dogs before and after compression had no effect on their susceptibility to the sickness, provided there was no lowering of the rectal temperature.

The mice also suffered less from decompression sickness when cooled during compression, but when exposed to 17 atm during cooling, followed by step-by-step decompression, the incidence and severity of the sickness were greater than in uncooled animals.

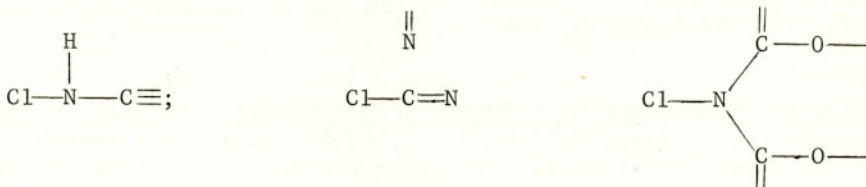
The observed effect of cooling is related to its influence on the rate of tissue saturation by inert gases. The work was done at the S. M. Kirov Academy of Military Medicine in Leningrad. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 775, August 20, 1962, p. 6)

CHEMISTRY

ORGANIC CHLORINE COMPOUNDS AS VULCANIZATION RETARDERS. According to A. Ye. Grinberg, V. G. Chertkova, and A. A. Potashnik in an article appearing in Kauchuk i rezifa, No. 6, June 1962, the Scientific Research Institute of Rubber and Latex Products has studied the effectiveness of a number of organic chlorine-containing compounds as vulcanization retarders.

The experiments were conducted with unfilled natural and filled butadiene-styrene rubber mixes with and without various accelerators. The effectiveness of the retarders was evaluated from the change in plasticity of the mixes when heated to 110°C and from the time elapsed before the onset of vulcanization at various temperatures. It is shown that the effectiveness of organic chlorine compounds depends on their chemical structure and the

position of the Cl atom in the molecule rather than on the number of Cl atoms and the Cl content in the molecule. Thus, the effectiveness of compounds in which chlorine is attached to the C atom in benzene or cyclohexane rings is low. In contrast, compounds with Cl atoms in the groups



are effective vulcanization retarders. Among these compounds the following are mentioned: N², N⁴, N⁶-trichloromelamine; 1, 3, 5 - trichloro-cyanuric acid; cyanuric chloride; and sodium 2, 4 - dichlorocyanurate.

The effect of these retarders on the optimum conditions of vulcanication and on the physical and mechanical properties of the vulcanizates was studied, and data potentially useful in the selection of the proper retarders in a number of cases are given. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 787, September 6, 1962, p. 1)

COMMUNICATIONS

HUNGARIANS TRANSMIT RADIO MESSAGES VIA METEOR TRAILS. The June issue of Radiotechnika, Vol. XII, No. 6, discusses how in 1961 Hungarian radio amateurs made contact with amateurs abroad on ultrashort wave bands by using meteor trails as reflectors. So far, messages have been exchanged with two English, one Dutch, and one Swedish amateur. The Dutch amateur received signals for about half an hour.

Radio amateurs in other areas are being urged to participate in the experiment. (Source: Joint Publications Research Service, OTS 61-11147-42, August 31, 1962, p. 13)

GEOSCIENCE

DETAILS ON SOVIET UNDERGROUND ROCKET. The underground rocket reported in the August issue of Space Intelligence Notes was discussed in greater detail in a recent issue of Ekonomicheskaya gazeta by N. Ilyinskaya. The "rocket" is actually a drill motivated by kerosene and oxygen burning and pushing gases out the nozzle at supersonic speeds up to 2000 meters per second.

The future of the drill appears to be in the field of mining. At present, the cost is reported to be quite high, with 70 percent of the cost being the oxygen involved. On the favorable side, however, is the efficiency

of the tool, which is given as 15 to 20 times higher than the conventional method. This brings down the overall cost of drilling to 10 times below the level of ordinary drilling.

The invention is credited to Professor A. V. Brichkin of the Kazakh Academy of Sciences in Soviet Central Asia. He was assisted by A. L. Kachan and a Soviet patent was issued to them in 1950. It wasn't until July 1959 that a working model was built. The project was then forgotten until May 10, 1962 when Premier Khrushchev spotted a rocket drill model in a newsreel. This led to a loud explosion by him and the charge of "bureaucrats" who "do not stir themselves, do not break the old, do not make way for the new" being hurled at the hapless Buzuluk machine building plant in the Trans-Volga region where the rocket had been tested and ruled of limited value.

At the present time, work is reportedly progressing rapidly with Professor Brichkin's group holding 40 patents for various uses of the rocket drill. One model, tried successfully for cutting and polishing granite rollers for paper making machinery, is reported to cut the stones at 16 to 20 times faster than conventional methods. To quote: "A square meter of a granite block's surface was finished in 40 to 50 min instead of the usual 12 to 18 hr." In Kiev, a rocket drill utilizing a mixture of ferric oxide and aluminum to control the temperatures of both the concrete and the drill's gas stream, was used to cut concrete for powerhouse construction. (Source: Missiles and Rockets, July 9, 1962, p. 34)

EARTH'S AGE INVESTIGATED. An intensive effort ¹⁶ is under way to determine the Earth's age states W. Pożaryski in Przegląd geologiczny, No. 4-5, 1962. At present, 12 Soviet laboratories are working on the determination of the absolute age of the Earth by radioactive decay methods. A special committee of the Academy of Sciences USSR coordinated their work and in June 1960 published a new time scale. Compared with the Holmes scale, in one half of the geologic periods there are no differences at all, and in the other half they are smaller than 10 percent. Taking into consideration the error of measurement indicated in the Holmes scale, the differences do not exceed 6 percent. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 782, August 29, 1962, p. 6)

INSTRUMENTS ²

FLYING LABORATORY. A recent issue of Geofizicheskoye priborostroyeniye, sbornik statey included a drawing (Fig. 2) of the Il-14M flying laboratory. The aircraft has been converted to serve the needs of the Main Geophysical Observatory.

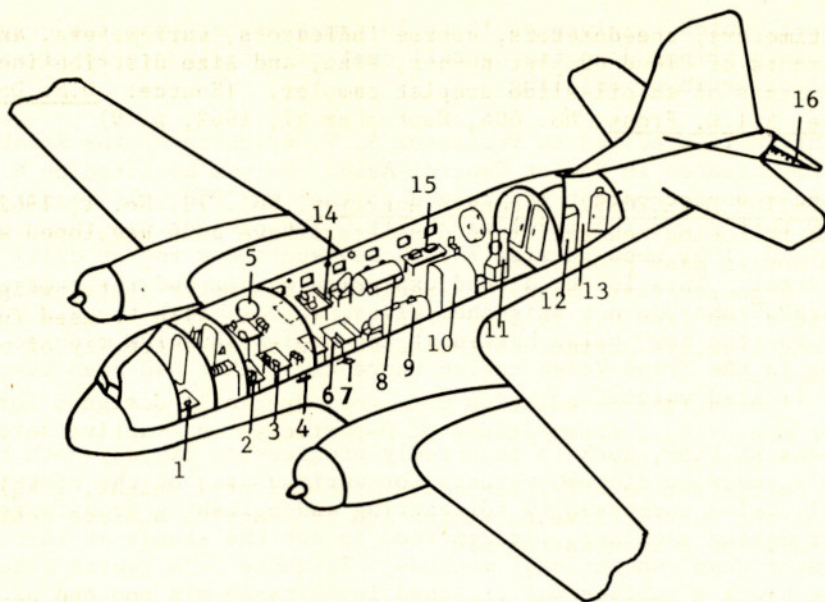


FIG. 2. Il-14M Flying Laboratory

1 - microphoto box; 2 - electric meteorograph; 3 - flight aerologist's station; 4 - air thermometer; 5 - blister; 6 and 14 - working benches; 7 - setup for icing observations; 8 - compressed air tank; 9 - liquid tank; 10 - cabinet; 11 - automatic dosing and granulating device for dry carbon dioxide; 12 - hopper for powdery reagents; 13 - photolab; 15 - instrument panel; 16 - sprayer of the liquid unit.

This specially equipped aircraft is intended for investigations of the physical properties of the atmosphere and the possibilities of artificial cloud treatment. The main elements, such as pressure, flying speed, and temperature and humidity of the air, are recorded with an electrometeorograph consisting of the optical self-recorder K4-51, pressure receivers HY-8202 and HY-8205, and galvanometric receiver HY-8250.

Temperature is recorded with a resistance thermometer wound around a cross-shaped frame. An organic film, connected kinematically with the rheostat, is used for recording humidity. A *СНВ*-type water gage and an intake for cloud samples are used to study the microstructure of clouds. The liquid reagent outfit consists of two tanks with a holding capacity of 600 liters, two cylinders with compressed air, a piping system, and a sprayer provided with a deicing device. Control boards are equipped

with altimeters, speedometers, course indicators, variometers, and clocks. Measurements of cloud-droplet number, size, and size distribution are made by means of an oil-slide droplet sampler. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 804, September 27, 1962, p. 9)

4? 46? 61?

NEW RADIATION DETECTORS. Atomnaya energiya, Vol. 13, No. 1, 1962, reports that the following new radiation dosimeters have been developed and tested, and are now in mass production:

1. A pocket-size "Signal" γ -radiation dosimeter (total weight 450 g) for γ -radiation from 0.1 to 5000 mr/hr, which can also be used for measuring α - and β -active surface contaminations with an intensity of ~ 200 decays/min/cm².

2. A universal β -radiation detector, specially designed for field use, for measuring concentrations of β -particles in β -active aerosoles up to $6 \cdot 10^{-14}$ curie/liter.

3. A field-type ИПП-1 radiation detector (total weight, 1 kg) for detection and quantitative determination of β -active surface contamination and γ -radiation dose measurements.

The latter detector has a measuring range of 100 to 1,000,000 decays/min/cm² for β -radiation and 0.05 to 200,000 mr/hr for γ -radiation. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 793, September 13, 1962, p. 2)

MATERIALS

30

BONDING OF FOAMED PLASTICS. An article appeared in Plasticheskiye massy, by L. M. Koval'chuk, telling of work done by the Central Scientific Research Institute of Structural Parts of the Academy of Construction and Architecture USSR in developing a new method of bonding foamed plastics by internal heating in an h-f electric field. The experiments were conducted with polystyrene (ИС-1 and ИС-4) and polyvinyl chloride (ИВХ-1) foamed plastics. Urea-formaldehyde (М-70, К-17, and МФ), urea-melamine-formaldehyde (ММФ), or phenol-formaldehyde (КБ-3) adhesives were used as bonding agents.

A thin layer of adhesive or water (in the case of ИВХ) was applied to the surface of one of the parts to be bonded; the parts were then pressed together (0.5 to 1.5 kg/cm²) and placed in the h-f field. With the resulting heating of the moist interlayer to 100°-130°C, the adjoining foamed plastic layers were fused and bonded.

The new method accelerates the bonding process to 5 to 7 sec in the case of ИС-1 or ИС-4 and to 3 to 5 sec in the case of ИВХ, compared to the 20 to 24 hr previously required. The method produces joints with a strength comparable to that obtained by cold bonding. However, in the case of the КБ-3 adhesive, strong joints were obtained only with ИС-1. Adhesive consumption is 150 to 200 g/m².

The degree of deformation of the foamed material is very slight and depends on heating time, type of plastic, bonding conditions, and pressure applied. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 789, September 10, 1962, p. 6)

METALLURGY

3*

BERYLLIUM "WHISKERS". According to an article by V. M. Amonenko and coauthors, which appeared in the June issue of Fizika metallov i metal-lovedeniye, the Physicotechnical Institute, Academy of Sciences USSR, has grown beryllium whiskers several tenths of a micron in diameter and several millimeters long. This was done by vacuum vapor deposition of 99.99 percent-pure Be on the inner surface of a cylindrical evaporation column made of molybdenum sheet.

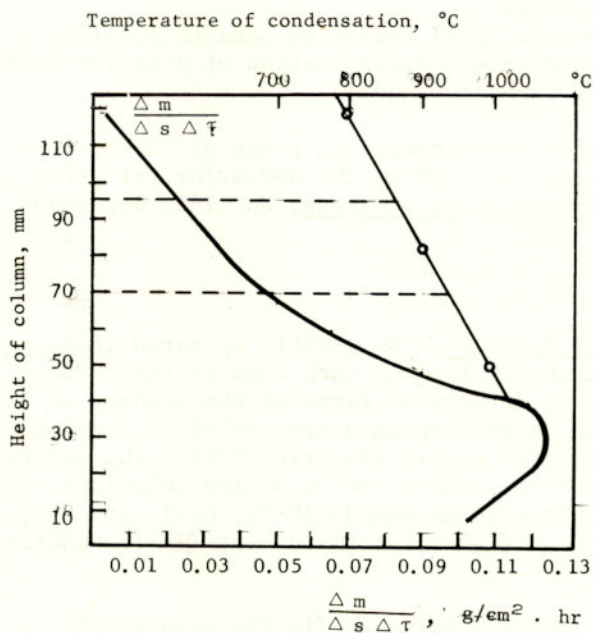


FIG. 3

An intensive growth of whiskers was observed at an evaporation rate of 0.4 to 0.9 g/cm²·hr. For an evaporation temperature of 1515°C, the condensation temperature was found to be 870° to 950°C and the condensation rate $\frac{\Delta m}{\Delta s \cdot \Delta \tau} = 0.02 - 0.05$ g/cm²·hr (see Fig. 3).

X-ray diffraction patterns showed that all specimens were single crystals with the direction of growth along [221], [331], and [111] axes. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 794, September 13, 1962, p. 5)

OCEANOGRAPHY ~~21~~

SOVIET UNDERWATER RESEARCH. V. G. Azhazha reports in Priroda, No. 6, 1962, on Soviet explorers of the ocean depths. He states that a newly formed Section of Underwater Research in the Oceanographic Commission, Academy of Sciences, is responsible for coordinating the work of 30 scientific institutions.

Specialists of the Polar Scientific Research Institute of Marine Fishing and Oceanography (PINRO) have constructed and are now using the new "GG-57" hydrostat, a deep-water apparatus which is lowered over the side of a vessel by cable. A record manned-descent of 608 m is claimed by PINRO through use of the GG-57.

Soviet scientists have now begun plans for a new scientific research submarine and a self-propelled apparatus which can reach depths of 2 km. Engineers M. N. Diomidov and A. N. Dmitriyev receive special comment as the designers of a Soviet bathyscape. (Source: Joint Publications Research Service, OTS 61-11147-42, August 31, 1962, p. 7)

PHOTOGRAPHY ~~36~~

IDENTIFICATION OF FEATURES ON FAR SIDE OF THE MOON. I. I. Breido and fellow workers present in Skusstvennye sputniki zemli, Vol. 9, 1961, a schematic map of the far side of the Moon with shading to represent the approximate distribution of brightness over the surface. The features on this map are numbered (107 of them) and an accompanying table gives the name of each object, the numbers of the negatives from which it was identified, and a description of its appearance on the negative. Of these objects, 56 are truly on the far side of the Moon, having longitudes greater than 90°. Another table gives the latitudes and longitudes of 23 objects, some of which are visible from the Earth.

Negatives and contact positives were used to identify surface features. One negative showed a large number of objects very clearly. Other negatives were used to check the existence of these and to fill in a few details.

Enlargement prints from certain negatives served to establish the selenographic coordinates of the objects. All the enlargements were made so that the diameter of the Moon's disc was 20 cm. From a knowledge of the satellite's position, a grid of latitude and longitude was constructed. By placing this on each of the enlargements, it was possible to read off the coordinates of a given object. Some difficulties arose from distortion of the pictures, but this was overcome by marking reference points on the grid and reading off positions only from those enlargements on which the reference points correspond best to those on the grid.

The best negatives were used to make prints on which the diameter of the Moon's disc was 25-30 cm. The purpose of this was to show up some details of the surface features. (Source: Planetary Space Science, Vol. 9, June 1962, p. 346)

PHOTOGRAPHIC PROCESSES USED TO PHOTOGRAPH FAR SIDE OF MOON. S. M. Antonov and coauthors, in an article for Skusstvennyye sputniki zemli, Vol. 9, 1961, discuss photographic processes used in taking the first photographs of the far side of the Moon.

Photography of the far side of the Moon involved consideration of the effect of cosmic radiation on the photographic materials and the development of suitable methods for processing film both on board the satellite and on the ground.

It was estimated from the expected flight time of the satellite and from the levels of normal cosmic radiation in space and the intensity in the Earth's radiation belt that the total radiation dose received by the film would be about 10^7 particles cm^{-2} . The effect of this on the film was calculated and found to be small. Experiments with particles from a betatron confirmed this result. Cosmic radiation was not therefore considered to be a source of complications.

The apparatus and materials to be used for processing the film on board the satellite were required to function under conditions of weightlessness, violent accelerations, vibrations, and considerable variations of temperature. A fine-grain film of medium sensitivity was chosen and this was subjected to a single-bath treatment effecting both development and fixing. Experimental work evolved a solution suitable for this single-bath process. This solution contained a surface-active compound and a thickener, but no other components are quoted. The developer-fixer bath was followed by a rapid water-wash and a rapid drying on a hot drum.

The sensitometric characteristics of the developing process vary little with temperature over the range 30° - 60°C or even higher. No detectable change in the characteristics of the developer-fixer occurred after storage at 20° - 40°C for 15 days.

A model of an apparatus for automatically carrying out the above processes was constructed and tested satisfactorily.

The images on the film processed on board the satellite were transmitted by radio to the Earth, and the final step in the sequence of operations was to process the film on which these signals were recorded. For this purpose, a low-concentration slowly acting developer was used. Since the conditions of exposure under which the original negatives had been obtained were not known exactly, test negatives were made to establish this and to select the correct times for developing the film on the ground. (Source: Planetary Space Science, Vol. 9, June 1962, p. 345)

PHYSICS

24 1. physics

MASER LINE WIDTH MEASUREMENT. A. I. Chikin of the Radiophysics Institute, Gorkii State University, recently gave a report on the measurement of maser line width in the Zhurnal Eksperimental noi i teoreticheskoi fiziki.

In deciding on a technique for measuring the very low output of masers, it was decided to measure line width by investigating the frequency fluctuations of audio-frequency beats between two identical masers.

Basov and Petrov's method was used to obtain beat frequencies from the output of a circuit receiving oscillations from both masers simultaneously. (Numerous references are made to articles appearing in Radiotekhnika i Elekhnika, 1, 832, 1956. Ed.) For continuous registration of the beat frequency the receiver output was connected to a frequency discriminator. Because of the extremely narrow line it would be technically difficult to employ conventional discriminators (circuits or delay lines), which would require larger initial signal voltages.

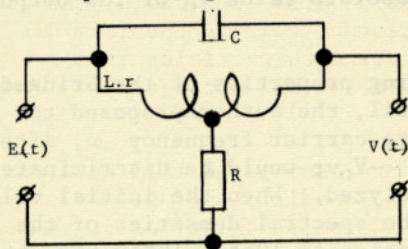


FIG. 4. Bridged-T circuit

Chikin's setup for discriminating frequencies is based on the properties of an inductance bridged-T network as shown in Fig. 4. With the bridge balanced, $4Rr = L/C$, the network input and output voltages are related by the following differential equation:

$$\ddot{V}(t) + 2\frac{r}{L}\dot{V}(t) + \omega_0^2 V(t) = \ddot{E}(t) + \omega_0^2 E(t), \quad (1)$$

where $\omega_0^2 = 1/LC$. The response of the bridged-T network to weak amplitude and frequency fluctuations

$$E(t) = E_0(1 + \alpha_t) \cos(\omega t + 2\pi \int v_t dt), \quad (2)$$

$$\alpha_t \ll 1, \quad v_t \ll \frac{\omega_0}{2\pi}$$

can be reduced by the substitution

$$U(t) = \omega_0^{-2} [\ddot{E}(t) + \omega_0^2 E(t)] \quad (3)$$

to the already solved problem of the response of the tank circuit represented by the left-hand side of (1) to an equivalent emf $U(t)$ with fluctuating frequency and amplitude.

Writing $U(t)$ and the output voltage $V(t)$ in a form similar to (2):

$$U(t) = U_0(1 + x_t) \cos(\omega t + \varphi_t), \quad (4)$$

$$V(t) = V_0(1 + y_t) \cos(\omega t + \psi_t), \quad (5)$$

we substitute (2) and (4) in (3) in order to determine x_t and φ_t and follow the procedure developed by Gorelik and Elkin. We then find that for slight detuning $D = (\omega - \omega_0)/2\pi \ll \omega_0/2\pi$ the spectral density $\overline{y_F^2}$ of the square of relative amplitude fluctuations in the output voltage is related to the spectra of fluctuating parameters of the initial oscillations (2) by

$$\overline{y_F^2} \approx D^{-2} \overline{x_F^2} + \overline{\alpha_F^2} + \overline{(\alpha v)_F} / D. \quad (6)$$

According to (6) the contribution of the first term (the useful effect) to the spectrum of relative amplitude fluctuations in the output voltage of the bridged T increases as the detuning D decreases. However, a calculation shows that at the same time the absolute value V_0 of the output voltage decreases.

For maximum utilization of the discriminating properties of the bridged-T network, which are manifested when D is small, the author proposed to amplify the discriminated signal $V(t)$ at its carrier frequency ω , after which the envelope of the amplified signal $\sim V_0 v_t$ would be discriminated by a detector, and its spectrum would be analyzed. When the initial voltage was $E_0 \approx 1$ V, this discriminator measured the spectral densities of the square of frequency fluctuations at frequencies to $10^{-8} - 10^{-10}$ cps, and thereby measured the absolute line width in the same range.

The principal limitations on the sensitivity of the entire setup were receiver noise ahead of the discriminator, thermal noise in the bridged T, and the shot effect in the amplifier of $V(t)$. Noise in the detector following the amplifier and noise in the envelope analyzer in our case imposed practically no limitation on the sensitivity, unlike previous techniques.

In the experiments with masers it was noted that when the bridged T was bypassed, the separately measured amplitude fluctuations and circuit noise induced in the analyzer output a combined effect $10^{-3} - 10^{-2}$ times smaller than the discriminated signal. This shows the high reliability of the data obtained on the spectrum of maser frequency fluctuations. (Source: Soviet Physics JETP, Vol. 15, September 1962, pp. 451-453)

POLARIZATION OF MAGNETIC NUCLEI BY THE PULSE METHOD. Fizika tverdogo tela, Vol. 4, No. 7, 1962, contains an article by U. Kh. Kopvillem and R. V. Shubina relative to nuclear and electronic spin systems.

The authors state that Schrödinger's equation is solved for nuclear and electronic spin systems with the simultaneous or sequential effect of two pulsed magnetic or ultrasonic fields taken into account. Formulas are obtained describing the initial amplitude of the electronic and nuclear free-induction signals and the magnetic polarization for nuclei with electric quadrupole moments in noncubic diamagnetic crystals and nuclei in paramagnetic ions.

It is shown that double pulse excitation of the spin system reduces observation of nuclear induction to observation of electronic induction and vice-versa. The sequential pulse excitation of a nuclear spin system in a paramagnetic medium is the most effective method of aligning nuclear spins. By using the two pulse methods, the nuclear spin system in paramagnetic and diamagnetic crystals can be totally polarized at helium temperatures. The polarization methods which use the pulse technique are independent of the relaxation mechanism and make possible the investigation of unstable excited states of magnetic nuclei.

Crystals in which Cr, Fe, and Mn impurities can be polarized are listed. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 793, September 13, 1962)

AMPLIFICATION OF LIGHT. A new method of utilizing the nonlinear properties of crystals to achieve amplification and modulation in lasers has been proposed at Moscow State University. S. A. Akhmanov and R. V. Khokhlov discuss this method in the July 1962 issue of Zhurnal eksperimental'noy i teoreticheskoy fiziki. 26

Given a medium whose polarization is a square-law function of the incident electric field intensity, it may be possible to obtain parametric amplification of traveling light waves in uniaxial crystals. The parametric amplification mechanism can thus be used in the design of frequency-tunable lasers. Such a system could be realized in practice by placing the laser crystal within two sets of parallel-mirror resonators. The system would control the dielectric constant of the material in various directions, utilizing the pumping field energy for this purpose. The conditions of energy exchange between fields could then be controlled in turn, making possible the modulation of amplified or generated oscillations. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 799, September 20, 1962, p. 2)

ANTIGRAVITY RESEARCH. E. O. Okonov, M. A. Podgoretskii, and others, writing in the Journal of Experimental and Theoretical Physics (USSR) say that interest in the question of "antigravity" has recently increased. It is known that the framework of contemporary physics assumes the absence of "antigravity." At the same time, the fundamental importance of the question compels researchers to look for an experimental method of verifying this assumption. 39

In principle, it would be possible to investigate the direction of vertical deflection of horizontal particle and antiparticle beams. If, for example, there were a horizontal beam of K_2^0 particles, then if the gravitational mass of the \bar{K}^0 is negative, the initial beam separates into two beams, with the K^0 particles deflected downward and the \bar{K}^0 upward. In practice, of course, this experiment is not feasible inasmuch as one is talking about macroscopic deflections. It is possible, however, to change the experiment in such a way that it may be possible to notice a deflection of the order of a de Broglie wavelength.

For this purpose, the authors consider a vertical beam of K_2^0 mesons, assuming that the gravitation mass of the \bar{K}^0 is negative. Upon passing through a height difference H , the difference in the K^0 and \bar{K}^0 energies becomes equal to $2mgH$, causing a phase shift between the respective wave functions ψ and $\bar{\psi}$ and leading ultimately to the transformation of the K_2^0 particles into K_1^0 particles with subsequent decay into 2π .

To estimate the possible effect, they start from the equations that describe the behavior of the K_1^0 and K_2^0 particles, taking attenuation into account:

$$\begin{aligned} d\psi_1/dt &= im_1\psi_1 - \delta\psi_2 - \lambda_1\psi_1/2, \\ d\psi_2/dt &= im_2\psi_2 + \delta\psi_1 - \lambda_2\psi_2/2, \end{aligned}$$

where m_1 , λ_1 and m_2 , λ_2 are the masses and decay constants of K_1^0 and K_2^0 mesons, and $\delta = mgvt/\sqrt{1 - \beta^2}$ (v is the velocity of the K_2^0 particle). Neglecting the time derivative of δ and assuming $\delta/\lambda_1 \ll 1$, the solution of these equations gives the following formula for the number of K_2^0 particles at a height H

$$N(H) = N(0) \exp \left[-\lambda_2 \frac{H}{v} - \frac{4}{3} \lambda_1 \frac{\delta^2}{\lambda_1^2 + 4(m_1 - m_2)^2} \left(\frac{H}{v} \right)^2 \right] \quad (1)$$

For a velocity $v \sim 2c/3$, the K_2^0 particle beam decreases to $1/e$ times its original value at a height $H \approx 9$ m.

The ratio of the number of two-pion decays to the number of three-particle decays at a height H (neglecting the little-likely decay of the K_1^0 meson into three particles) equals

$$\begin{aligned} n(K_1^0)/n(K_2^0) & \\ &= 4\delta^2(H/v)^2 \lambda_1 / \lambda_2 [\lambda_1^2 + 4(m_1 - m_2)^2], \end{aligned} \quad (2)$$

which leads, for $\lambda_1 \sim 10^{10} \text{ sec}^{-1}$ and $\lambda_2 \sim 1.7 \times 10^7 \text{ sec}^{-1}$, to the value

$$n(K_1^0)/n(K_2^0) \sim 5 \cdot 10^{-6} H^2.$$

It is not difficult to see that Eq. (2) is correct both for a vertical beam and for an inclined beam with vertical component equal to H. It is necessary to emphasize that at present the authors cannot offer a closed system in which antigravitation and the conservation of gravitational mass could coexist with the interference properties of the K^0 mesons. By the same token, they cannot prove on the basis of logical arguments alone that such a coexistence is impossible. Therefore it seems that a logical analysis of the situation would be usefully supplemented by the actual performance of the experiment discussed above.

It is obvious that a difference in the inertial masses of the K^0 and \bar{K}^0 particles $[M(K^0) - M(\bar{K}^0)]$ also leads to the appearance of K_1^0 decays in a beam of K_2^0 mesons. In this case the ratio of both types of decays will be

$$\frac{n(K_1^0)/n(K_2^0)}{n(\bar{K}^0)/n(K_2^0)} = \frac{(\lambda_1/\lambda_2)(M(K^0) - M(\bar{K}^0))}{[\lambda_1^2 + 4(m_1 - m_2)^2]}$$

Investigations of the decay properties of K_2^0 mesons have shown that $n(K_1^0)/n(K_2^0) \lesssim 1/400$. Assuming $|m_1 - m_2| \sim \lambda_1$, they obtained $|M(K^0) - M(\bar{K}^0)|/M \leq 10^{-17}$. (Source: Soviet Physics JETP, September 1962, p. 537)

PRODUCTION ENGINEERING

EXPLOSIVE WELDING STUDIED BY RUSSIANS. The Institute of Hydrodynamics of the Siberian Department, Academy of Sciences, USSR, is investigating the possibilities of solid-state welding of metals by pressures exerted through explosions. They claim to have been successful with steel to steel, copper to copper, titanium alloy to titanium alloy and copper to aluminum welds by this method. Best results were achieved with trimethylenetrinitramine, but exact positioning techniques had to be employed. (Source: Missiles and Rockets, September 10, 1962)

SOVIET PROJECTS IN MACHINE-TOOL BUILDING. A number of major projects bearing on the development of machine-tool building in the USSR were completed by the Experimental Scientific Research Institute of Metal-Cutting Machine Tools in 1961 reports A. A. Podogin in Stanki i instrument, No. 6, 1962. Standard types were developed for transfer machines and machine tools for future use in transfer lines, high-productivity machine tools for machining turbine blades in centralized production, and unit-type machine tools for centralized production.

Investigations were conducted on the electrochemical machining of more than 25 metals and alloys, hot rolling of gears, and a new type of fluid-film slider-type self-adjusting bearing for high-precision machine tools.

Additional advances include a new method for external cylindrical grinding in which the surface being ground is used as a setting base, the honing of heat-treated gears with a gear-shaped tool prepared by hot pressing of abrasive powder, five types of numerically controlled copy-milling machines, and an increase in the productivity and precision of electrospark and ultrasonic machining.

A new "4723" electrospark machine was developed with an automatic feed selector, microscopes for coordinate setting, a size-control device, and a wide variety of fixtures. (Source: U.S. Dept. of Commerce, A.I.D. Press, 794, September 13, 1962, p. 5)

GIANT MACHINE TOOLS. Among the extra-large machine tools manufactured by the Kolomna Heavy Machine Tool Plant are the "5355C" hobbing machine (weight, 237 tons) for cutting gears 12.5 m in diameter with a precision of 10 to 15 μ ; the "1594" vertical turning and boring mill (weight, 1400 tons), which can machine parts up to 20 m in diameter and more than 6 m in height; two vertical-turning and boring mills, the "1A596" for machining parts 20 m diameter and about 6.5 m high, and the "1B596" for parts 25 m in diameter weighing up to 700 tons (both in the design stage, the latter to be \sim 20 m high and to weigh \sim 1930 tons); and the "KY-64" and "KY-65" machines equipped with television units for better observation of the cutting process and tool conditions in boring operations.

These machines are described in Tekhnika molodezhi, No. 7, 1962. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 797, September 18, 1962, p. 5)

PROPULSION

HYPERVELOCITY PROPULSION. In a theoretical study of the acceleration to hypersonic velocity of a model by a conductive gas flow, the application of the Lagrange problem is considered. N. N. Popov discusses aspects of the study in Vestnik. Seriya I: Matematika mekhainka, No. 4, July-August 1962.

Numerical solutions of the classical problem by the method of characteristics are presented for the case of a piston moving in a cylindrical tube. Different values of two nondimensional parameters, i.e., adiabatic index γ (1.67, 1.4, 1.22) and the gas-to-piston mass ratio μ (0.5, 1, 2, 4, 8, 10) are assumed and graphs are plotted.

A generalization of the Lagrange problem for the solution of this problem in the case of a conductive perfect gas and in the presence of an electromagnetic field is presented, and the effects of different forces (ponderomotive, pressure, and induction) on the conductive gas (plasma) flow are analyzed. A method of solving the Lagrange problem in this case is proposed and a solution for a gas of infinite conductivity is presented. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 804, September 27, 1962, p. 6)

RADIO ASTRONOMY

SUPERLONG WAVE LENGTHS. B. Koltovoy, in a brief article carried by Nedelya, No. 22, May 27-June 2, 1962, discusses the recent discovery of waves of astronomical length--up to 30 million km (and possibly more). It is unknown what information is carried by these waves or what their origin may be. Their period is 100 sec. 65

The waves may be associated with solar corpuscular radiation, but no receiver can pick up these waves. They were first discovered by indirect methods using high-frequency instruments which detected changes in the magnetic component of the mysterious waves. (Source: Joint Publications Research Service, OTS 61-11147-42, August 31, 1962, p. 13)

SPACECRAFT

AIR AND WATER SUPPLY IN SOVIET SPACESHIPS. An article appearing in Neues Deutschland, an East Berlin newspaper, states that a cosmonaut in space needs the following per day: 900 g of oxygen, 2,200 g of water, and 500 g of food. It also describes how carbon dioxide is removed, and states that the size of air conditioners depends on the length of the stay in space. 48

Four methods of insuring the oxygen supply are outlined, and the role of algae is discussed. The article also describes how to get water. It says that man can act as his own source of supply. The water originating from breathing, perspiration, and urine can be filtered or distilled. The operation of an air conditioner is also described. (Source: U.S. Dept. of Commerce, A.I.D. Press, No. 795, September 14, 1962)

TELEMETRY

RADIOMETRIC EQUIPMENT ON SECOND SOVIET SPACE SATELLITE. Skusstvennye sputniki zemli, Vol. 9, 1961, carries an article by S. F. Pankov and colleagues pertaining to the apparatus carried on the second Soviet satellite. 12

The radiometric apparatus consisted of a sodium iodide scintillation counter (A) with an FEU-16 photomultiplier, two STS-5 gas-discharge counters (B), and a caesium iodide scintillation counter (C) with an FEU-15 photomultiplier. Counter A, mounted inside the satellite, registered charged particles penetrating the skin and also γ -quanta with energies greater than 25 keV. Counters B, also mounted inside the satellite, recorded only charged particles. Comparison of measurements made by counters A and B thus enabled the composition of the radiation to be analyzed. Counter C was mounted on the outer skin and measured the energy flux of comparatively soft charged particles.

A description, together with a block diagram, is given in the original source of the general arrangement of counters, amplifiers, trigger circuits, etc. The electronic devices are based on semiconductor diodes and triodes. Circuit diagrams are given for the principal components: a current discharge device for converting the anode current of a photomultiplier into a series of pulses; an amplifier for the photomultiplier pulses, consisting of two successive stages and giving an amplification factor between 50 and 150; an amplifier-shaper stage for pulses from a gas-discharge counter; various trigger circuits.

All the apparatus was tested and calibrated before mounting in the satellite. The coefficient of proportionality between the energy liberated in the sodium iodide crystal and the current at the output of the photomultiplier of counter A was measured. The same was done for counter C. The energy threshold of the counting channel of counter A was determined. The dependence of the count rate of counters B on the dose size was established by means of standard γ -sources.

Furthermore, experiments were conducted to determine how the readings of the counters depended on the direction of the radiation and also to determine the resolving power of the counting channels. Tests after the apparatus had been returned to the ground showed that the equipment was still functioning properly. (Source: Planetary Space Science, Vol. 9, June 1962, p. 349)

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

Gel'man, A.S., et al, Investigation of Steel Grades and the Manufacture of Welded Steel Shafts of Large Water Turbines. 1959, 12 p.

Welded steel shafts on large water turbines are technically possible and economically desirable, claim Soviet technicians in a comparison of welded and forged parts. Definite economic advantages are claimed for the welded type--metal used, labor, cost--in a report now available from the U.S. Department of Commerce.

Russian engineers made various designs of welded shafts at the Leningrad metal plant while planning turbines for two hydroelectric stations. They give two ways for producing welded parts:

1. Cast flanges joined by electric slag welding to a shell forged from a hollow ingot.
2. Cast flanges welded to a shell welded from thick bent plates.

Soviet experts say the first method uses 41 percent less metal, shortens production cycles by 37 percent, decreases labor needs by 10.6 percent, and energy used by 38.4 percent. "All this leads to a 33.5 percent price reduction.... "

This book can be obtained from the Office of Technical Services, U. S. Department of Commerce. Order number is 60-51134. (Source: U.S. Dept. of Commerce Release, OTS 62-427, August 6, 1962)

Kurnosova, L. V., Artificial Earth Satellites, Vol. 6. Plenum Press, New York, 1961.

The following review is by Mr. W. F. Hilton and appeared in the Journal of the Royal Aeronautical Society, March 1962.

"It would seem that the Russians are also suffering from this type of book, which is in reality a set of ten disjointed technical papers, many of which have merit, merit in widely differing fields. The consequence is that an engineer or scientist is asked to buy a book containing 10 separate articles, of which perhaps two are of interest to him... Seems doubtful if the twenty authors contributing to this book ever met to discuss the volume as a coherent whole. Having said this, the fact remains that this book reveals many interesting facets on Russian thinking in Space." (Source: Technical Book Review Index, August 1962)

n.a., Soviet Science and Technology; A Bibliography on the State of the Art, 1955-1961. Superintendent of Documents, Government Printing Office, Washington, D. C.

A bibliography intended to provide researchers, librarians, and students with basic information on Soviet scientific and technical activity has been completed by the Science and Technology Division of the Library of Congress with the aid of a Foundation grant. This 209-page compilation contains approximately 2000 annotated entries for periodic and monographic materials from Soviet bloc and Western sources published for the most part in 1955-61.

References selected for the bibliography fall into four main categories: surveys, bibliographies, reports of visits to Soviet scientific and industrial institutions, and articles deemed to show significant Soviet programs in particular fields. Entries are arranged alphabetically by author or first word of title under approximately 100 subject headings. These headings, along with cross references, are listed in a subject guide at the end of the bibliography.

Most of the items listed are available in the Library of Congress, and call numbers and special identifying numbers have been included when known. Titles in languages of the Soviet block have been translated, while those in Western languages have not been. Partial or complete translation of the text is indicated by a note in which the original source is given.

Continuation of this bibliography, now broadened in scope to include the Soviet-bloc nations of Eastern Europe, is well advanced, with upwards of 1000 completed entries on cards.

Copies of Soviet Science and Technology; A Bibliography on the State of the Art, 1955-1961, may be obtained for \$1 each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. (Source: Scientific Information Notes, Vol. 4, No. 3, June-July 1962, p. 12)

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Sochilina, A. S., On the Accumulation of Errors in the Numerical Integration in Certain Problems of Celestial Mechanics. 1961, 11 p. 4 refs. (61-16448/0160)

Myachin, V. F., On the Estimation of the Error in the Numerical Integration of Equations in Celestial Mechanics. 1961, 44 p. 3 refs. (61-16449/0460)

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Fedynskii, V., Look Out: Meteor! November 22, 1961, 4 p. (62-15171/0110)

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Leonidov, K., Launching Lunar Rockets. November 6, 1961, 6 p. (62-13340/0110)

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Sedov, L. I., Dynamic Effects in the Motion of an Artificial Satellite. 1961, 22 p. (4 figs. 1 table omitted) 9 refs. (62-14003/Loan Only)

Zonov, Yu. V., On the Problem of the Interaction Between a Satellite and the Earth's Magnetic Field. 1961, 29 p. (foreign text included) 4 refs. (62-14009/Loan Only)

n.a., Soviet Space Science. November 16, 1961, 15 p. (62-13553/0160)

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Gringauz, K. I., Bezrukikh, V. V., and Ozerov, V. D., Results of Measuring Positive-Ion Densities in the Ionosphere with Ion Traps in the Third Soviet Earth Satellite. December 1961, 48 p. 18 refs. (62-13589/0460)

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Gurevich, A. V., Perturbations in the Ionosphere Caused by Moving Body. November 20, 1961, 23 p. 3 refs. (62-15178/0260)