M-MS-IS

Space INTELLIGENCE NOTES

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

August 1961 Vol. 2 No. 8

FEATURED ARTICLES

<u>SCIENTIFIC SHAKE-UP IN THE SOVIET UNION</u>. Notwithstanding the big claims and the real achievements, there is reason to believe that all is not well in Russia's scientific community. There has, indeed, been a big shake-up in the administration of scientific affairs. The most significant factor involved in the shift of power is between the Party and the Army. Hitherto, the Party has been in full control of all scientific activities. The permanent Secretary of the Academy of Sciences, A. V. Topchiev, has always been a supporter of the party drive in scientific as well as other matters. Another important personality in the Academy of Sciences has been P. N. Pospelov, candidate-member of the Party Presidium.

Topchiev and Pospelov between them guaranteed party control of the 260 scientific institutes and the 34,000 scientific workers in the Soviet Union. The Academy of Sciences also dealt with all the foreign scientific relationships of the U.S.S.R. All this involves vast power and prestige. In the finely balanced equilibrium of the Soviet Government a shift of control over scientific affairs must therefore be noticed.

<u>The Changes</u>: The first change took place early in April. By a decree of the Presidium, the Academy of Sciences was divested of much of its authority in scientific affairs in favor of a State Committee for the Coordination of Scientific Research. This committee has been made what is virtually a scientific general staff. It makes decisions on all research proposals, allocates funds and equipment, decides the budgets of all scientific institutes, and deals with all foreign scientific contracts.

The committee is made up of five men, and the Academy of Sciences has only one representative.

The president was to have been Lt. General Krunichev, who has since died Krunichev was an Army man, rather than a Party man, and his appointment suggested that control had passed from the Party to the Army. (It is significant that his replacement, Konstantine N. Rudnev, was formerly chairman of the Council of Ministers for Defense Technology.)

In mid-May a shake-up took place within the Academy. The President, 62-year-old Professor A. N. Nesmeyanov, resigned and then took over the direction of the Institute of Chemistry at Moscow University. He also resigned from the chairmanship of the committee which awards the Lenin prizes. He has been replaced as President of the Academy by 50-year-old Professor Keldysh, Professor of Space Mathematics and Aerodynamics, and twice winner of the Stalin prize.

Nesmeyanov and his Successor: Nesmeyanov had presided over the Academy of Sciences since 1951. He had recently been criticised by certain technical experts and accused of allowing research to become too theoretical, at the expense of immediate military and technical needs.

His successor, Professor Keldysh, is a well known scientist from a scientific family. His father, now 83, is a member of the Soviet Academy of Architecture, and was already well known in scientific circles during Czarist times.

In his scientific work the new President of the Academy has been in close touch with the armed forces, especially in research in aerodynamics and hydrodynamics. He is generally supposed to be relatively disinterested in political affairs. He has played a big part in aircraft construction, and has been a member of the Academy since 1946.

Keldysh will represent the Academy of Sciences on the new State committee, and it is likely that he will pay closer attention to the needs of the armed forces than his predecessor did. (Intelligence Digest, July, 1961)

ESPIONAGE AND OUTER SPACE. The Soviet Union has denounced the United States' launchings of two experimental observation satellites as acts of espionage and aggression.

Krasnaya Zvezda, newspaper of the Soviet armed forces, compared the orbiting of the Tiros III weather-reporting satellite and the Midas III rocket-detection satellite with flights over the Soviet Union by the United Sates U-2 reconnaissance plane.

Both satellites, launched July 12, pass over the Soviet Union. "A spy is a spy no matter at what height it flies," the official newspaper declared.

There is little surprising in the Soviet Army newspaper's bitter complaint that the orbiting of the Tiros and Midas satellites represented espionage on the part of the United States. Tiros provides an independent source of information about Soviet weather when it passes over that country. Through infrared sensors Midas III is able to report launchings of missiles by detecting flame from the rocket exhausts. The United States hopes that development of the Midas project will lead to establishment of a missile-defense alarm system for the West.

The Soviet assertion that observation at any altitude represents aggression raises a legal issue. Space above the atmosphere is literally a lawless region. It is governed by no agreed body of rules; and even so elementary a question as where the atmosphere ends and space begins has never been settled. At present the simple truth is that any nation is free to do what it pleases--within the limits of its technological capabilities--in the regions where Earth satellites roam. Existing international accords recognize a nation's sovereignty over its air space. But there is no agreement on how far up air space extends.

The United States implicitly acknowledged a violation of Soviet air space when Captain Powers flew his U-2 over the Soviet Union at an altitude of twelve miles. But the question of sovereignty in space has not yet been the subject of international negotiation.

The Soviet Union itself began this business of doing what one pleases in space. The first two man-made satellites to go into orbit--the Soviet Union's Sputniks I and II--flew over many countries without their permission.

Moreover, there is reason to suspect that Moscow may not have clean hands on this issue. That the Soviet Union has the ability to send camera-equipped satellites into space to spy on other nations is clear. It was a much more difficult feat to send a satellite to take pictures of the other side of the Moon, pictures which were then transmitted to Earth and published with much propaganda by the Soviet Union. The nation which performed that remarkable feat--and which has so often demonstrated its interest in other nations' business--may have well included cameras and picture-transmitting equipment in its satellites without announcing such action.

So long as the Soviet Union contributes to a high degree of world tension and tries so hard to keep much of its life secret, it must expect that others will attempt--in self-defense--to penetrate that secrecy. If the Soviet Union really wishes to end American use of what it calls "spy" satellites, it can do so by lessening world tensions and thereby helping create an atmosphere in which it would be possible to establish, through the United Nations, an acceptable body of space law governing all countries. (New York Times, July 24-25, 1961)

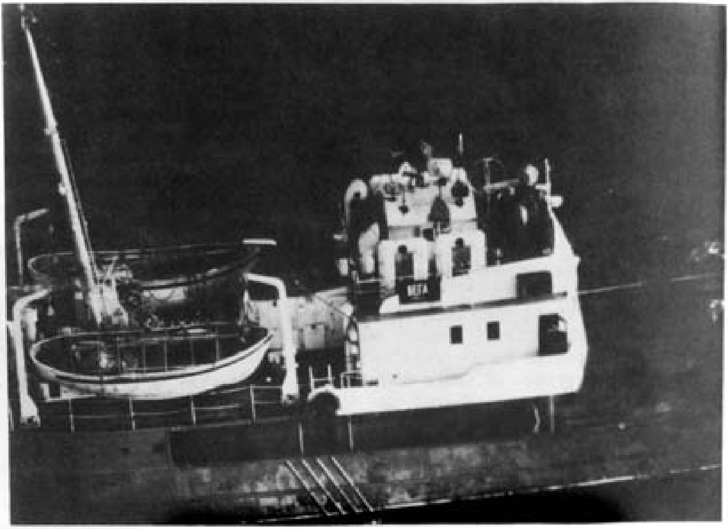
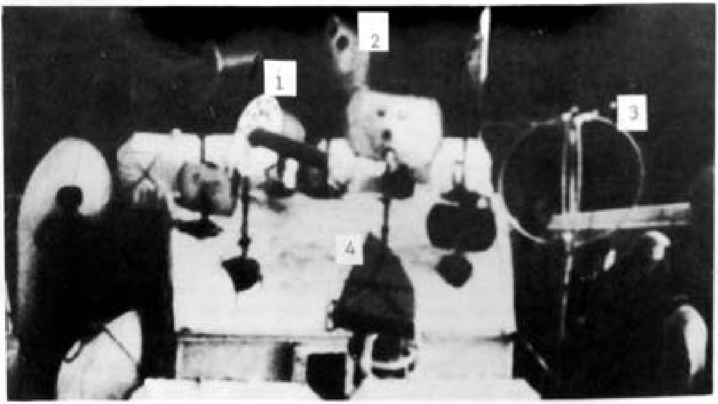


Fig. 1. Russian trawler Vega, home port, Murmansk, photographed while maneuvering off East Coast of United States.



Close-up showing Vega's radar and telemetry equipment.

1. helical antenna, 400-500 m.c.
2. active HF radar antennas
3. radio direction finder
4. parallel plate radar antenna

SOVIET "FISHERMEN" OBSERVE U.S. SPACE SHOTS. Radar-equipped Russian trawlers off the east coast of Florida apparently watched the return of America's two astronauts from space.

These trawlers, one of which is shown in Fig. 1, appear quite frequently in areas where U. S. rockets and space vehicles are being tested. The Soviets are apparently well ahead of the U. S. in fishing as well as in space science since our fishing boats aren't nearly so elaborately equipped.

Informed sources said "at least one" Soviet ship stood by near the target area on each occasion--May 5, when Navy Comdr. Alan B. Shepard,Jr. rode a rocket into space, and last Friday when Air Force Capt. Virgil I. Grissom made a similar flight.

The Mercury capsules that carried Commander Shepard 116.5 miles and Captain Grissom 118 miles dropped by parachute into the Atlantic a little more than 300 miles southeast of Cape Canaveral.

The Russian vessels were believed to have kept tabs on the parachute descent of the capsules into target areas more than 100 miles east-northeast of Grand Bahama Island. The trawlers were identified by United States aircraft stationed near the target area, sources said. (UPI July 25, 1961)

Fig. 2. Soviet merchant-type ship, The Sibir, observed in the Pacific Ocean about 700 miles south of Midway Island and 1200 miles west of Honolulu. Considerable electronic equipment can be seen mounted on the super structure.

PLENARY SESSION OF THE COMMISSION ON RADIOASTRONOMY. An expanded plena session of the Commission on Radioastronomy of the Astronomical Council and the Radio Council of the Academy of Sciences of the USSR was held during the period 22-28 November 1960 in Moscow.

Participating in its work were representatives of observatories, resear institutes, universities, and other organizations which conduct researc in this field. Reports and communications were delivered which make it possible to form an idea of the activity of the radioastronomical insti tions of the Soviet Union in the principal branches of radio-astronomy during the three years which have elapsed since the preceding plenary session.

In the session devoted to problems of apparatus, A. Ye. Salomonovich reported on the construction of the 22-meter radiotelescope of the Oka station of the Physical Institute im. P. N. Lebedev. This instrument makes it possible to make scientific observations in a wide range of wavelengths. The accuracy of fabrication of the 22-meter mirror is so high that it is possible to pick up the radio noise of heavenly bodies on short waves of the order of 1 cm (V. V. Vitkevich). The properties of radiotelescopes with a reflector of variable shape, such as the larg Pulkovo antenna, were discussed also (S. E.Khaykin, Yu. N. Pariyskiy, a N. L. Kaydanovskiy.

The emphasis in present-day study of the physics of the Sun is the study of coronal condensations, flares, and the emission of solar radio radiation and active optical phenomena. These problems were examined in reports on investigations of coronal radiation made at the Main Astronomical Observatory of the Academy of Sciences of the USSR (S. E. Khayki on the development of a theory covering the sporadic radioradiation of the Sun (V. L. Ginzburg, V. V. Zheleznyakov, and others), and on the investigation of the upper layers of the Sun's atmosphere--the Sun's outer corona (V. V. Vitkevich).

The greatest number of reports dealt with the radio noise in the Galaxy and discrete sources. I. S. Shklovskiy demonstrated that radio galaxies are massive and young galaxies whose distinguishing characteristic is the ejection of radio radiation substances. An example of such a radio galaxy is a peculiar multiple galaxy in Cygnus. Yu. N Pariyskiy used the great Pulkovo radiotelescope to investigate the most mysterious part of our Galaxy -- its center, as well as a number of discrete sources. He provided a theoretical interpretation of the results of these observations and received important data on the structure of the nucleus of the Galaxy.

Other reports provided information on discrete sources of radio noise, studied by use of the 22-meter radiotelescope of the Physical Institute; on the polarization of radio noise from the Crab nebula discovered on the wavelength λ = 20 cm; observations of a sector of the Milky Way in the neutral hydrogen line on the wavelength λ = 21 cm; the spectrum of nonthermal cosmic radio radiation; and the present-day status of radio-astronomical theory of the origin of cosmic rays.

A great contribution has been made by Soviet astronomers to the investigation of the radioradiation of the Moon and planets. Work is progressing for the purpose of developing a theory of the thermal radioradiation of the Moon (V. S. Troitskiy). Radioastronomical methods are presently being used for making lunar observations at Moscow, Gor'kiy, and Pulkovo.

The radioradiation of Venus is being studied with the 22-meter radio-telescope of the Oka station.

A series of scientific sessions was devoted to problems of the investigation of the upper layers of the atmosphere by radioastronomical methods. The work was discussed which has been accomplished by use of artificial Earth satellites; this includes investigations of inhomogeneities in the ionosphere and the absorption of radio waves in the ionosphere, and the relationship between flares of solar radioradiation and geomagnetic effects.

In connection with the establishment of a series of new radioastronomical institutions, the plenary session decreed an expansion in the size of the Commission on Radioastronomy. It was pointed out that there is a need for improving the radioastronomical work of the Sun Service, a matter of great practical and scientific interest, and for strengthening the coordination of research in radioastronomy and optical astronomy. ("Plenary Session of the Commission on Radioastronomy," by B. N. Panovkin, Vestnik Akademii Nauk SSSR, No. 2, 1961, pp. 104-105) (Office of Technical Service)

SOVIET SCIENTIST DISCUSSES VENUS SHOT. Information on the 12 February 1961 Venus shot is reviewed in an 8-page article by Professor G. V. Petrovich writing in Vestnik Akademii Nauk SSSR. Prof. Petrovich says that the launching of the heavy satellite 7 days prior to the Venus shot solved all problems connected with placing a heavy satellite into a specified orbit and in doing so the necessary experience and means for carrying out future programs of cosmic space research were achieved. In speaking of the 4 February satellite, Prof. Petrovich states that its weight, less that of the carrier rocket, was 6,483 kg, and that its orbital parameters were as follows: orbital period, 89.8 minutes; perigee, 223.5 kilometers; apogee, 327.6 kilometers; and orbital inclination, 64° 57'. No recovery of the satellite was intended so no such systems were incorporated in craft. The satellite entered the dense layers of the atmosphere on 1 March after having completed over 400 revolutions of the Earth and burned. The carrier rocket lasted about a week after launching and made about 100 revolutions.

The launching of a space rocket from a satellite is advantageous becaus of the possibility of more effectively using the energy potential of th rocket system and considerably decreases the rigid limitations of the calendar time-table for launching a rocket in a specific direction. In orbiting the Earth, a satellite occupies a number of successive positio which present a wider possible choice in selecting the optimum launch moment.

In the case of the Venus shot, the heavy satellite's trajectory was measured by special facilities located on the territory of the Soviet Union and showed that it had been orbited with great accuracy. The orbital elements were: perigee, 230 km, apogee, 287 km, and orbital inclination, 65°. Operation of the units and systems of the satellite were controlled by radiotelemetric stations in the Soviet Union and on special ships at sea.

Turning to a consideration of the most effective means of studying the planet of Venus, Prof. Petrovich says this would consist of sounding the atmosphere and of dropping of buoyant landing stations. All of thes means will probably be used in the not too distant future, he says.

It is presumable, he continues, that after the beginning initiated by the Soviet Union in 1961, rockets will be launched every year and a half on the Earth-Venus route. (The First Interplanetary Trip--Earth Venus, by G. V. Petrovich; Moscow, Vestnik Akademii Nauk SSSR, No. 3, 1961, p. 53-60) (Office of Technical Services)

√ RADAR OBSERVATIONS OF VENUS. The observations of American scientists and of two Soviet Scientists, Vladimir Kotelnikov and I. S.Shklovskiy,* of the Academy of Sciences, concerning the rotation of Venus were summarized in the June and July issues of SIN. The complete translation of the report by the Soviet academicians has now become available. The following are some of the highlights of their study.

The radar observations of the planet Venus that have been made indicate that the surface of the planet has regions for which the coefficient of reflection of radio waves is different.

If Venus rotates on its axis in 225 earth-days, the same as it does aroun the Sun, the same side would always be turned toward the Sun and the natural conditions in the day and night hemispheres would be completely different, making it extremely unfavorable for the development of life on Venus.

---

*A few copies of "Is Communication Possible with Intelligent Beings on Other Planets", a translation of an article by Shklovskiy appearing in Priroda, are still available from M-MS-IS.

Determining the period of rotation of Venus was previously attempted in 1903-1911 by the Russian astrophysicist A. A. Belopol'skiy by means of the spectroscopic method, but with negative results. This method is based on wavelengths of any spectral line of light shifting either in the long-wave direction or in the short-wave direction, depending on whether the light source is approaching or withdrawing (the Doppler effect). In 1958 Richardson used extremely modern instruments in an attempt to determine the rotation of Venus by the Belopol'skiy method but the results were again negative. The only conclusion drawn from these observations is that if Venus rotates westward, its period of rotation exceeds seven days; and if it rotates in the opposite direction, the rotation is greater than 3.5 days.

Another problem is the extent of the inclination of the axis of rotation of Venus to its orbital plane. If it is assumed that the axis of rotation is perpendicular to its orbital plane, then there will be no season changes. However, Earth's axis is inclined to its orbital plane at an angle of 66° 33'; Mars is 64° 48', with season changes occuring as a result.

The American astronomer Kuiper determined the inclination of the axis of Venus to its orbital plane. He postulated that on Venus, as on Earth, there is general circulation of clouds in a direction parallel to the equator. From observations in the ultraviolet of the trend of distribution of cloud formations covering the surface of Venus along parallel lines, he found that the axis of rotation is inclined to its orbital plane at an angle of 58° which would result in seasonal changes on the planet. The Soviet astronomer V. I. Yezerskiy also received evidence of seasonal changes by the use of photometric observations.

In the radar method, the studied object is covered by radio waves from a transmitter and the waves reflected from it are received back. By studying the time elapsed in the travel of the radio signals, it is possible to determine the distance to the object. If the object is moving, then due to the Doppler effect the wavelength and the frequency of the reflected oscillations will differ from those sent by the transmitter. Thus it is possible to determine the velocity of approach or withdrawal of the studied object. If the object is rotating, its different parts will give reflected signals of different frequencies. From this broadening of the frequency spectrum of the reflected oscillations, it is possible to judge the rate of rotation and theoretically possible to judge the nature of the surface of the parts of the planet which are approaching and withdrawing from us at different rates during rotation.

Radar observations of distant celestial bodies previously have been impossible because the necessary power of the radar transmitter must increase proportional to the fourth power of the distance to the cosmic body and inversely proportional to the square of its diameter. In 1958 when Venus made its closest approach to the Earth, Russian scientists recorded the radio waves transmitted from the Earth and reflected from Venus. The power of the radio waves amounted to 15 watts and the difference in radial velocities of individual reflecting portions of the surface of Venus was equal to approximately 80 meters per second.

The conclusion therefore was drawn that the period of rotation of Venus is close to 11 days (assuming that the axis of its rotation is perpendicular to the direction Earth-Venus, and on the assumption that all parts of the surface of Venus reflect). If the inclination of the axis of Venus is assumed to be in agreement with the results of Kuiper, the period of rotation for Venus should be considered as close to nine days.