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# SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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PLEASE NOTE

This report presents unevaluated information on Soviet Bloc International Geophysical Year activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

# SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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# I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

## Layka Experiment Discussed by Member of Academy of Medical Sciences USSR

"Tomorrow is the anniversary of launching of the second Soviet artificial Earth satellite.

"It was on 3 November 1957 that Soviet science and technology gained another great victory when they placed Sputnik II into orbit with a living organism as its passenger: a dog named Layka. This event was of great significance because it was the first step toward realization of man's dream to become master of the universe.

"Considerable work has been done during the year just past in deciphering data concerning physiological reactions of Layka. This data was transmitted to Earth by radio. Other experiments conducted, under simulated conditions, contributed significant data for evaluation by biological and medical scientists.

"Since space in the cabin holding Layka was limited, and since the weight of equipment and sources of food supply had to be taken into consideration, the data obtained, out of necessity, had to be confined to some of the most important physiological reactions of the animal, such as blood circulation, respiration, and reactions of the organism of the dog in general. Determination of circulation of the blood can be made by the function of the heart and the blood vessels. Activity of the heart was recorded on an electrocardiogram, which presented a graphic tracing of electric currents produced by each contraction of the heart. Another important index of blood circulation is the degree of arterial blood pressure. Recordings of respiratory movements were used to evaluate respiration of the animal. The general condition of "Layka" (excitation and inhibition) was secured by determining the main movements of the skin.

"All movements made by the animal were converted into impulses of electric current with the aid of a potentiometric transducer. Temperature of the air and air pressure in the cabin were recorded simultaneously with the aid of suitable transducer.

"Layka was selected from a number of dogs, which were put through a long period of systematic training.

From the time the rocket left the Earth to the time the artificial Earth satellite entered the prescribed orbit, the organism of Layka was subjected to action of great forces of gravity. Since all investigations, both abroad and in the Soviet Union showed that accelerations are more easily endured by animals and men if they act in a transverse line (chest to back), Layka was placed inside the cabin in such a way that acceleration acted on its body in the direction of back to chest.

"It was possible to evolve three principal periods in the course of thds experiment with the second Soviet Earth satellite:

1. Prior to launching of the rocket, at the moment the animal was placed inside the hermetic cabin.

2. Beginning at the time the rocket was launched, but before the satellite entered the orbit.

3. The period during which the satellite was in orbit.

"A thorough and long period of training of Layka ensured the animal's calm behavior in the cabin prior to launching of the rocket. The function of the heart, blood pressure, and respiration were the same as those recorded under conditions normal for this dog.

"During the second period, the animal was exposed to great forces of acceleration, exceeding by many times the force of gravity of the earth. At the same time, it was also exposed to vibration and motor noise. Decipherment of radio signals, received during this period, indicated that "Layka" was not restless in any way. Heart beats were three times greater than was noted at the beginning of this period; no pathological changes in the function of the heart were apparent. Higher frequency waves on the electrocardiagram, appearing during that period, evidently represent reverberations of contraction of muscles of the body. Respiration frequency, at the time acceleration was at its height, was three to four times greater than it was at the beginning. This was mainly due, in all probability, to considerable compression of the chest caused by sharp increase in acceleration. Changes in arterial pressure corresponded entirely to those noted in laboratory experiments.

"Over-all analysis of data obtained revealed that Layka endured all perturbations, that took place from the time the rocket was launched to the time the satellite entered its orbit, in a very satisfactory manner.

"The main feature that characterized the physical condition of the environment surrounding Layka, during its prolonged stay in its orbit, was a condition of dynamic weightlessness. Before the second Earth satellite was launched, weightlessness was studied in experiments in which animals were sent up in rockets and stayed up only 5-6 minutes. This part of the experiment was of special interest, because it was not yet known how the animal organism would react to prolonged action of weightlessness. Moreover, solution of this is significant for the study of physiology and hygiene of outer space.

"The data obtained showed that with transition to a condition of dynamic weightlessness, frequency of heart beats and respiration and blood pressure began to return to initial state. However, it took approximately three times longer for those functions to return to original state than under laboratory conditions (on a centrifuge).

This situation is quite interesting and places before researchers a number of questions connected with the peculiarities of reflex control of functions of animal organism under conditions when the effects of the forces of gravity are absent.





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"During the entire period of weightlessness the principal functions of Layka were satisfactory.

"Results of the biological experiment with the second Soviet Earth satellite proved that a highly organized animal organism is capable of enduring in a satisfactory manner, in a hermetic cabin, the effects of the accelerations which are necessary to attain the speed that will assure entrance of a rocket-cabin into orbital rotation around the earth. The second important conclusion reached is that a living organism is capable of enduring in a satisfactory manner a prolonged condition of dynamic weightlessness.

"Both these conclusions are important because they present a definite assurance that no unknown dangers will turn up or have to be watched for when humans begin to travel in outer space.

"Of course, many technical obstacles and many problems remain yet to be solved. Some of those problems may eventually be solved through biological and medical research. Further perfection of instruments will enable scientists to make a more complete and more thorough telemetric study of functions of animal organisms travelling through space.

"Long range plans for flights into outer space consist of the development of devices which will guarantee return of animals to earth. Experiments to develop such devices are important, because if animals can be returned to earth, evaluations then will be possible of harmful effects of cosmic radiation not only on animals themselves, but also on their descendants. A number of other long and short range scientific projects are being contemplated.

"The time is ripe to unify all scientific knowledge in the field of cosmic biology and medicine. This can be done by organizing research establishments of specialized nature within the framework of the Academy of Sciences USSR or within the framework of the Academy of Medical Sciences USSR. This would create a possibility for expediting solution of such questions which, like the experiment with Layka, are necessary stages on a complicated road toward realization of the prophesy of K. E. Tsiolkovskiy: a daring invasion of cosmic space by man." ("Prior to Incursion of Man Into Outer Space," by V. Parin, Active Member of the Academy of Medical Sciences USSR; Moscow, Izvestiya, 2 Nov 58)

Use of Photon Motors for Space Ships Discussed by Soviet Engineer

Interplanetary rockets capable of spanning the vast distances to other planets are possible in principle, says Yu. Sushkov, Soviet engineer. Such rockets must be propelled, for example, by photon motors developing thrust through light pressure.

Einstein's theory of relativity includes the law of the interrelation of masses and energy which states that the liberation of energy in any process is accompanied by a decrease in the mass of the matter involved in the process. The greater the decrease of the mass, the greater the liberated energy.

At present, nuclear reactions in which matter is fully annihilated are known. In this reaction, one form of matter -- a substance is transformed into another of its forms -- electromagnetic radiation carries the released energy away with it. The use of this type of reaction in rocket motors presents the possibility of making future interplanetary flights.

Modern rocket motors create thrust by the pressure of gases on the walls of the combustion chamber. In annihilation-type reactions, matter is fully converted into radiation and consequently does not have gas-forming products from the reaction, which makes it impossible to obtain thrust by the usual means. Therefore the thrust in such a motor must be created by the pressure of electromagnetic, and in particular light radiation, formed during the reaction.

Electromagnetic radiation is emanated in peculiar forms, which have received the name of quanta or photons. Hence the name of quantum or photon motors has been given to motors creating thrust through radiation pressure.

The operating principle of such a motor is as follows. The reaction takes place in a "combustion chamber" and the photons which are formed are deflected by means of a reflector to one side in a parallel beam similar to the jet of modern reactive motors. The pressure of light on the mirror creates the reactive force of the thrust.

At present we are confronted with extremely small values of light pressure. Thus for example, the force of the pressure of solar rays acting on a ship flying in a cloudless sky would measure a hundredth part of a gram. Annihilation reaction will make it possible to obtain a light pressure of any magnitude.

A consideration of certain scientific and engineering problems on whose solution the possibility of creating photon motors depends reveals three related problems. The first is the transformation of matter into radiation. At present, antiparticles can be produced in elementary particle accelerators. The encounters of antiparticles with electrons form photons. These reactions will be of practical value when scientists can find economical methods for producing antiparticles and develop methods for their accumulation and storage.

The second problem is the conversion of the wave lengths of the radiation. The reason for this is that "firm" short wave gamma radiation is formed in the reaction. At present, there is no known material from which it would be possible to make mirrors for reflecting gamma rays. Therefore, along with the search for methods of reflecting them, it is necessary to work on the conversion of gamma photons into light photons, that is, on increasing the wave length of the radiation.

The cooling of the mirror and the "combustion chamber" is the third problem. For the light pressure on the mirror surface to consist of one atmosphere, the necessary flow of energy must be about one million kilocalories for each square centimeter per second. Therefore, the mirror is photon motors will be greatly heated even if only a slight portion of the radiation energy is converted into heat.

These problems are an indication of the difficulties faced in the creation of a photon rocket motor.

The question arises whether it would be possible to build a photon motor using regular thermonuclear reactions. Theoretically, it has been shown that a photon thermonuclear motor in which a kilogram of hydrogen is converted into helium each second can develop a thrust of 210 tons. A rocket motor in which the pressure of the gasforming products of a thermonuclear reaction is used to create thrust with the expenditure of the same amount of fuel can develop a force 17 times greater.

This example shows that in all cases when matter is not fully converted into radiation, the photon motor appears to be less advantageous than rocket motors, the thrust of which is created by gas pressures. Preference will be given to the photon thermonuclear motor only in case it proves to be technically easy to achieve.

The problem of fuel storage aboard a rocket whose motor will operate continuously for a period of several years is also to be considered. Calculations show that without the use of matter obtained from surrounding space, interplanetary flights are impossible.

Cosmic matter will be gathered by special collectors and fed into the "combustion chamber," where it will be converted into radiation. How will this be done? For the accomplishment of annihilation reactions it is necessary also to admit "antimatter," together with the usual substances used. If "antimatter" is found in much smaller quantities in space than the usual matter, there remains only one answer -- to develop some principally new method, unknown to science at present, for converting matter into radiation. Up to now, such a method has not been developed and interplanetary flights are unrealizable despite the presence of operating annihilation reaction motors.

The creation of a photon motor will open a new perspective in space travel. Such a motor using a kilogram of fuel for annihilation reaction each second, will develop a thrust of about 30,500 tons. To escape from the solar system, the rocket must burn a quantity of fuel measured in thousandths of a percent of the initial weight of the rocket.

Interplanetary flights will be made at a speed near that of light. One of the conclusions of the theory of relativity is that the closer a ship travels to the speed of light, the slower time passes on it in relation to the passage of time on Earth.



Sushkov says that "---our proposed interplanetary ship would fly from the Earth to the nearest star, its speed increasing up to the halfway mark and from that point decreasing so that the weight of all the bodies on the ship would equal their weight on Earth. In this case the craft would reach its goal in 6.15 years. The ship's passengers would age only 3.6 years. If the motors' thrust were increased so that the apparent weight on the ship would be three times greater than the "terrestrial" weight, then the passengers would achieve their goal according to their own clocks in 1.77 years while on Earth, 5.15 years would pass.---."

"At present, the creation of an annihilation reaction photon motor seems to be the work of the very distant future. However, the vigorous and more accelerated development of science and engineering during recent years, and in particular the successes achieved by Soviet scientists and engineers will considerably accelerate the creation of the new type motor."
("Photon Rocket," by Yu. Sushkov, Engineer; Moscow, Sovetskaya Aviatsiya, 6 Aug 58)

Soviet Brochure on Space Ships Reviewed

A 72-page brochure, Korabli Mezhplanetnykh Prostranstv (Interplanetary Space Ships), by Yuriy Semenovich Kryuchkov, presents some problems which arise during flights in terrestrial space and the means for their solution. The leading role of Soviet scientists and inventors in the development of astronautics for science and in the development of designs of interplanetary motors is cited.

Kryuchov briefly considers the forces and resistances a rocket must overcome to get beyond the Earth's field of gravity and indicates the most characteristic conditions of flight in cosmic space. The principles of rocket motors and basic dynamics are very briefly set forth. Tsiolkovskiy's formula for calculating ships' velocities is given, and the importance of the calorific value of fuel mixtures and oxidizers is discussed. In addition, Kryuchkov stresses the point that multistage rockets and nuclear propulsion in one form or another have special value for cosmic flights.

Kryuchkov discusses future interplanetary craft, the methods of organizing flights, take-offs and landings, sources of power, rocket guidance during flight, safeguards against meteors, and other problems.

A small amount of information on certain designs of apparatus for creating artificial satellites and apparatus for interplanetary flights is given. Finally, specific concrete problems for a flight to the Moon and around it from a special base built earlier on an artificial Earth satellite are presented. The characteristics of flights to Mars, Venus, and Mercury and other planets are discussed, as well as flight conditions beyond the limits of the solar system.

A review of this work, by M. Timofeyev, appeared in the newspaper Sovetskaya Aviatsiya.

Timofeyev says that the scope of problems touched by the brochure is sufficiently wide and that the work can be useful for a general knowledge of the problems of interplanetary flights. However, Timofeyev says it is regretful that it contains such significant shortcomings that they should be pointed out.

Timofeyev doubts very much that categorical statements are permissible on how apparatus will appear (p 56), how breaking approaches to the Earth will be performed (p 46), how landings must be made (p 47), how rockets will be controlled during the flight (p 49), etc., because the development of interplanetary craft, as yet, is still in the stage where it is only possible to express assumptions.

The author presents contradictory data without corrections and tolerates a number of errors. It is inconceivable, for example, why it is necessary to use 175 jet motors if a rocket is accelerated only up to a speed of 140 kilometers per second and to an altitude of 900 meters (p 53). On page 13, the author indicates that the reactive principle of motion was discovered by Newton in 1686, when in reality, powder rockets (the author notes this very fact on p 15) and other devices using this principle were known long before this time.

On page 25, the author gives the speed of exhaust gases from a nuclear reaction motor as 15,000 meters per second, while in Table 6 on the same page, the velocity is shown as 8,500 meters per second. On page 27, the "Maximum Velocity" of the exhaust gas from an atom rocket is again described as 15,250 meters per second. No attempt is made to explain either the differences or how these velocities were obtained.

The author in different places gives different values for the flight speed necessary to overcome the Earth's attraction, giving no explanation of them and without indicating the starting altitudes. Thus, on page 8, this velocity near the surface of the Earth is indicated as 11,200 meters per second, on page 58, as 3,000 meters per second, and on page 66 as 3,129 meters per second.

Timofeyev concludes his review by saying that these and other shortcomings not set forth in his review are evidence of the necessity for more careful editing of similar brochures before publication.

A bibliography of 12 works is given at the end of the book for those desiring a more detailed knowledge of other subdivisions of astronautics, such as the biology of cosmic flights, radio control, astronomy, etc.

("Interplanetary Space Ships," by Yu. S. Kryuchkov, Moscow, 1958, 72 pages; and "Interplanetary Space Ships" review by M. Timofeyev; Moscow, Sovetskaya Aviatsiya, 31 Aug 58)

## II. UPPER ATMOSPHERE

### Plenum of Commission on Physics of Planets Held in Kharkov

The plenum of the Commission on Physics of Planets was held in Kharkov, 20-22 May. Astronomers of a number of USSR observatories, representatives of the Astronomical Council, and Chan Yu-che, director of the Nanking Observatory, took part in the work of the plenum.

The reports which were made almost wholly concerned the results of observations of Mars in 1956 and investigations of the surface of the Moon.

V. V. Sharonov, on the basis of a comparison of colorimetric and photometric observations of Mars which he conducted in the Tashkent Observatory, with the results of laboratory study of the reflective capability of samples of the covering from Earth deserts according to a method of constructing brightness-color diagrams, established the absence of a relation between them in regard to brightness and light. The surface of Mars was somewhat darker and considerably (approximately 0.6) redder. N. P. Barabashov revealed the principal results of absolute photographic photometry of Mars in six parts of the spectrum which he conducted jointly with I. K. Koval' at the Karkhov observatory. It was established that the dimensions of Mars' south polar cap decreased in a parallel manner in all rays of the spectrum; fluctuations in the brightness of the south polar cap bore one and the same character in all the investigated parts of the spectrum. Color readings, of the center of Mars' disk in the course of the entire period of observations changed very insignificantly and on the average consisted of $1^m.6$ (magnitude).

Some photometric results of parts of the surface of Mars obtained by the Department of Astrobotany, Academy of Sciences Kazakh SSR, on the AFM-3 electrophotometer of the AZT-7 telescope, were presented by K. I. Kozlova and Yu. V. Glagolevskiy. In the opinion of A. N. Suslov, the intensity of $O_2$ telluric lines undergo such a marked fluctuation that it must be taken into account in observations of the planet. The results of a spectrophotometric study of Mars conducted in the Crimean Astrophysical observatory were given in a report by N. P. Barabashov, V. I. Yezerskiy, and A. T. Chekirda. Noting the necessity for expanding the instrumental basis of planetary investigations, N. P. Barbashov brought up the question of the organization of a planetary institute.

N. D. Kalinenkov reported on details of spectrophotometric observations of the surface of Mars which were conducted in Kazan, and B. A. Bronshten and O. B. Rzhanitsyna reported on the results of photographic photometry of the bright region of Argir [transliterated from the Russian] from 60 photographs of Mars obtained on the refractor of the Stalingrad

Planetarium. The change in the brightness of the bright region of Argir proved to be different in different parts of the spectrum, and while in the blue rays from this region it was not generally noticed, in the red and yellow rays a marked (15-20% during days) increase in brightness was observed.

An electron-optical transducer was used for the first time in the Main Astronomical Observatory at Pulkovo for photographing Mars in the infrared rays ($\lambda\lambda$ 840 and 983 millimicrons) (M. M. Butelova, A. A. Kalinyak and L. A. Kamionlo).

Chan Yu-che reported how the Nanking Observatory intends to engage in the joint work on the investigation of planets and already looks forward to using the experience of the Kharkov Astronomical Observatory in the current year to conduct photographic observations of Mars.

The principal material on the latest investigations of Mars conducted abroad were presented by V. V. Sharonov.

The results and the prospects of investigations of the Moon were discussed in a number of the reports.

N. P. Barabashov's report, dealing with the most immediate problems and methods of investigating the Moon, set forth the preliminary results of complex investigations of the Moon by different methods already begun -- spectrophotographic, polarimetric, radiometric, etc.

B. Yu Levin and S. V. Mayeva spoke on the principal results of theoretical investigations of the thermal history of the Moon and Mars which they conducted on the supposition that the content of radioactive matter in them corresponded to the content in meteorites. A hypothesis of the gravitational differentiation by observation data (the value of the moment of inertia) for Mars was not verified. Consequently, convections ceased heating at the stage when the matter was very viscous, and therefore relatively small iron inclusions did not collect in the nucleus but remained distributed throughout the whole.

In B. Yu. Levin's report "History of the Rotation of the Moon and the Geological properties of its Matter," arguments were presented in favor of the theory that solidification of the Moon came about in conditions of free rotation, and that the rotational deceleration of the Moon came about later as a result of a substantial dissipation of energy which accompanied tidal deformations of the solid Moon by terrestrial attraction.

N. N. Sytinskaya's report which was read by V. V. Sharonov, contained a development and new bases for an earlier presented theory by the author on the nature of the lunar cover. According to this hypothesis the ultrabasic and basic bedrock is covered by the products of the recent action of the impacts of meteorites which caused the formation of a certain crust of a slag-like nature.

A. V. Markov reported how an apparatus was set up at Pulkovo for obtaining thermoelectrical measurements of the temperature of a narrow belt of the lunar surface. It was proposed to conduct these measurements in a parallel manner with radio astronomical observations. The first results of the work with this apparatus were presented (Yu. N. Chistyakov).

The prospects of the investigation of the thermal radio emission of the Moon was discussed by N. N. Kaydanovskiy. On the basis of electropolarimetric observations of features of the lunar surface conducted by Ye. K. Kokhan at the Abastumansk observatory, using light filters, it was established that in blue rays, the degree of polarization was found to be greater in comparison to other parts of the spectrum.

N. P. Barabashov and I. K. Koval' acquainted the gathering with the preliminary results of investigations of the polarization of the Moon, using light filters (both by photographic and photoelectric methods). The necessity of calculating differences of the degree and location of polarization of lunar features during their simultaneous spectrophotographing, was shown in a number of examples by Yu. N. Lipskiy.

The reports of T. A. Polozhentseva, V. G. Teyfelya, A. N. Sergeyev, N. P. Barabashov, V. I. Yezerskiy, and V. A. Fedorets were devoted to a determination of the values of color contrasts of the lunar surface by a photographic spectrophotometric method. All present arrived at the conclusion concerning the presence of marked color contrasts on the lunar surface which reached a value of 0.2-0.3 on the scale of the color index. ("In the Astronomical Council, Plenum of the Commission on Physics of Planets," by A. T. Chekirda, Candidate of Physicomathematical Sciences; Moscow, Vestnik Akademii Nauk SSSR, No 8, Aug 58, pp 113-114)

## III. METEOROLOGY

### Soviet Meteorological Instruments Described

Soviet barographs and thermographs are among the finest meteorological instruments for graphically following changes in the temperature and pressure of the air.

Thermographs are used at meteorological stations to record regularly the temperature of the air. The sensing element of the instrument is a movable bimetallic point which is mechanically connected with the recording apparatus. The recording apparatus is enclosed in glass to protect it from the elements. The instrument sensing element is inside this glass case. Two types of Soviet thermographs are made: the M-16 c for 24-hour service and the M-16 H for weekly service. The recording drum of the M-16 c revolves once every 26 hours, that of the M-16 H once every 176 hours. These thermographs have a range of minus 35 to plus 45 degrees centigrade. The timing mechanism of the M-16 c thermograph has a deviation of plus or minus 5 minutes per 24 hours, that of the M-16 H thermograph of plus or minus 30 minutes per week. The dimensions of the instrument are 360 x 195 x 135 millimeters.

Soviet meteorological stations use the M-22 c (24-hour) and the M-22 H (168-hour) barographs for continuous measurement and recording of atmospheric pressure. The sensing elements of these instruments are metallic vacuum chambers. Atmospheric pressure is recorded in a manner similar to that used for recording temperature. It is recorded on a specially preprinted paper band on a recording cylinder which is turned by a time mechanism mounted in the apparatus. The barographs have a range of 960-1,050 millibars. The accuracy of the timing mechanism and the period of revolution are the same as for the M-16 c and the M-16 H. The instrument will give accurate readings in temperatures from minus 10 to plus 40 degrees centigrade. The barographs' dimensions are 225 x 195 x 135 millimeters and weigh 3.5 kilograms.

Soviet barographs and thermographs are equipped with a year's supply of recording paper, replacement recording springs, and special ink.

The new Soviet automatic radio rain gauge M-4 is one of the many new meteorological instruments which have unlimited importance for observations in mountainous and inaccessible areas. It is designed to measure rainfall and to transmit the information to the nearest meteorological station by radio. The instrument works on the principle of converting the determined amount of rainfall into radio signals in the form of letters.

The apparatus is made up of two parts, one for measuring, the other for transmitting, which together form one unit. This unit is supplied with a removable cover. The upper portion of the cover comprises an opening with an area of 500 square centimeters which catches the rain. When it rains, the drops caught by the opening flow through a funnel into the measuring element which is divided into two parts, one for collecting the raindrops, the other for drainage. When the collecting bucket is full (capacity is 50 cubic centimeters, which represents one millimeter of rainfall) the balance of the bucket is upset, it tips, and empties out. The bucket then returns to its original position thus assuring the continuous operation of the instrument.

The number of times the bucket tips is automatically counted by an electrical device. A coding device converts the number of oscillations into radio signals (letters) which are transmitted after every second tipping of the "boat." Each transmission consists of a call sign, which is different for each instrument, and signals indicating the amount of rain that has fallen. The signals are deciphered according to code tables. The intensity of the rainfall can be determined by the time lapse between individual transmissions. The instrument may be located as much as 50 kilometers away from the receiver. The transmission equipment requires a 24-volt battery, a 440-volt plate battery, and a 4.4-volt heating cell. The transmitter's antenna is 12 meters high.

The BM-1 barothermohygrometer is designed for measuring atmospheric pressure, temperature, and relative humidity indoors (in storage rooms, in work shops, etc.)

It consists of the following parts:

The barometric part, which consists of a sensitive measuring element, reacts to even the slightest changes in atmospheric pressure. It is a self-regulating vacuum chamber, a metallic pressure measuring device. Changes in its lift are transferred to the hand of the instrument by means of a very precise and a very delicate mechanism.

The degree and tendency of these changes in air pressure during a certain period (24 hours, for example) may also serve as orientation points in making weather forecasts.

The hygrometric parts consists of a sensing element which reacts to changes in the relative humidity of the air. It is a "Kapron" fibre ("Kapron" 200), whose length varies with humidity. A sensitive mechanism transfers these changes to the indicator.

The thermometric part measures the temperature of the air by means of a precise capillary pressure gauge, which is affixed to the scale of the instrument.

The barothermohygrometer measures air pressure from 700 to 800 millimeters mercury, temperatures from zero to 40 degrees centigrade, and relative humidity from 30 to 100 percent. The instrument weighs about 0.6 kilograms. Its dimensions are 105 x 155 x 70 millimeters. The case of the "BM-1" is an attractive one made of synthetic material. ("Soviet Meteorological Instruments," by J. Langer; Prague, Kridla Vlasti, 16 Sep 58, pp 26-27)

Harmonic Analysis or Geomagnetic Data

The traditional treatment of the results of magnetic observations includes the isolation of the solar diurnal variations $S_a$, $S_q$, $S_d$, and $S_D$. Ordinarily it is customary to consider the difference $S_d - S_q$ equal to $S_D$, the net perturbed daily solar variation. Stated another way, $S_d - S_q = S_D$ is considered the result of the action of factors caused by magnetic storms. The question of the accuracy of this identification is examined here in connection with results obtained by V. N. Mikhalkov (Trudy TGO, No 4 (5), 1950; Ibid, No 9 (10), 1954; Meteorologiya i gidrologiya v Uzbekistane [Meteorology and Hydrology in Uzbekistan], Tashkent, 1955).

The initial material used was the mean diurnal variation of three components X', Y', and Z of the magnetic field of the Earth for an 11-year cycle of solar activity, from 1922 to 1933, from 17 magnetic observatories located between 64° north and 48° south geomagnetic latitude. Fourteen observatories are located in the northern hemisphere and three in the southern hemisphere. A list of the observatories is given.

The diurnal variation is considered a function of the geomagnetic latitude $\phi$ and of the local geomagnetic time $t_M$, inasmuch as the perturbed variation depends more on $\phi$ and $t_M$ than on geographic latitude and local solar time.

In the conversion from the geographic to the geomagnetic coordinates and times, use is made of formulas given by B. M. Yanovskiy (Zemnoy Magnetizm [Terrestrial Magnetism], GIZ, Moscow, 1953).

After allowance has been made for acyclic variations, it is seen that the diurnal variation of the components of the magnetic field of the earth represents for each observatory a periodic function of the local time with a 24-hour period. A harmonic analysis is then made to determine the spectra of diurnal variations according to trigonometric functions with periods of one, one-half, one-third, etc., day. For this purpose, the diurnal variation is broken down into a Fourier series with a number of terms which give, for practical purposes, a sufficient approximation. In the formulas, X' represents the northern geomagnetic component, Y' the eastern geomagnetic component, Z the vertical component of the geomagnetic field, and $t_M$ the local geomagnetic time.

The harmonic analysis is made of the diurnal variations which were average for the year and for the season (winter, equinox, summer), for $S_q$, $S_d$, and $S_D$-variations. The results of the harmonic analysis of the average annual diurnal variation are tabulated.

A comparison of the results of various seasons shows that there are definite seasonal differences in the diurnal variations. The amplitude of perturbed diurnal variations X', Y', and Z in winter, for example, are 25 percent below the yearly, and those of the summer approximately the same as the yearly. In comparison with the yearly value there are also considerable differences in the phases of the diurnal variations in winter and in summer for the middle latitudes. The amplitudes of the perturbed diurnal fluctuations during the equinox are, for example, 20 percent greater than the yearly values. There is, however, no appreciable difference in phase in comparison with the yearly values. All this was confirmed by a graphical comparison of the results of the analysis.

The diurnal variation of the perturbation is actually very close to a sinusoidal 'S with a 24-hour period, but the component "$S_q$, both in amplitude as well as in phase, is close to "$S_d$, so that the amplitude difference "$S_d$ - $S_q$ is negligible. Furthermore, the amplitudes and phases of this difference do not reveal a definite dependence on latitude.

The results of this analysis thus confirm the conclusions of Mikhalkov. It is shown that if a sufficiently long series of observations is conducted, then, in the harmonic analysis as well as in the calculation of the voltage and current functions for the perturbed diurnal variation, it is possible to limit the calculations to the separation and use of only one first harmonic '$S_d$, rather than the aforementioned $S_D = S_d - S_q$.

It is further shown that, with a calculation by the Mikhalkov method, the voltage and current function will possess a longitudinal symmetry in regard to the meridional plane. In calculations by earlier used methods a small amplitude and longitudinal asymmetry was observed, because a harmonic of a higher order was taken into account in the diurnal variations. This asymmetry, however, is very slight -- not greater than 10 percent in amplitude and not greater than one hour in latitude displacement.

The conclusions reached are deemed worthy of use in future treatment of IGY data. ("On Methods of Mathematical Treatment of the Results of Magnetic Observations (Harmonic Analysis), by M. G. Antsilevich, Institute of Mathematics and Mechanics, imeni V. I. Romanovskiy; Tashkent, Izvestiya Akademii Nauk UzSSR, Seriya Fizikomatematicheskikh Nauk, No 2, 1958, pp 87-93)

## Further Exploration of Antarctic Interior by Soviets

According to a radio report from Mirnyy, the principal column of the overland sled-tractor train left the Pravda Coast on 23 October. The traverse party included 22 polar scientists, headed by A. Nikolayev, Candidate of Technical Sciences. Some of the drivers, mechanics, navigators, and radiomen had already previously taken part in a continental exploration party, at the time the station Sovetskaya was established in February 1958.

The new train consists of six caterpillar tractors and one "Pingvin" oversnow vehicle. Mobile huts, an electric power station, radio station, and a navigator's hut, are installed on the eight metal sledges, which also carry freight for the interior stations.

The course of the train is set for the station Komsomol'skaya. At this point the train will meet with the scientists of a group which arrived earlier and is now conducting research work in the interior. At Komsomol'skaya, the train will be divided into two columns: one will deliver freight to Vostok, and the second will proceed to the pole of relative inaccessibility. Seismic research will be conducted on the way, as well as research in the fields of glaciology, meteorology, terrestrial magnetism, and gravimetry.

The Soviet scientists will establish a new scientific station in the area of the pole of relative inaccessibility, which is to operate during the summer period. ("Today in Antarctica," Moscow, Vodnyy Transport, 25 Oct 58)

## Soviet Transantarctic Flight to McMurdo

The Soviet scientists visiting the US antarctic base McMurdo were given a hearty welcome. They were met by Rear Admiral Dufek, chief of the US antarctic operations; the chief of the Central Antarctic Weather Bureau, Grey; and the Soviet meteorologist P. Astapov, who had flown over specially from Little America, where he wintered with the US antarctic expedition.

The Soviet scientists spent one day at McMurdo. They became familiar with the work of the US scientists, and also visited the New Zealand station, Scott, situated near McMurdo.

On 26 October at 0020 hours, the Soviet plane took off on its return flight. This time, the course was almost on a direct line back to the Pravda Coast. After a flight of 8 hours 20 minutes, covering a distance of over 2,500 kilometers, the plane landed in Mirnyy.

During the transantarctic flight, the scientists conducted observations to determine the elevations of the antarctic ice sheet in regions where no human explorers had set foot before. No mountains or crevasses were observed in the region between the station Sovetskaya and the south geographic pole.

The whole flight of over 6,500 kilometers was supported by Soviet and US radio operators, who continuously followed the course of the flight, supplying the plane with necessary weather data. ("A Courageous Flight," Transantarctic Flight of Soviet Polar Workers, Moscow, Vodnyy Transport, 28 Oct 58)

When the Soviet plane was scheduled to take off from McMurdo on its return flight to Mirnyy, the weather report announced a cyclone which was penetrating into the central regions of Antarctica. This could complicate the return flight, and it was decided therefore to change the route and fly a different course, i.e., directly across the mountains and unexplored regions of East Antarctica, from the coast of the Indian Ocean to the Pacific Ocean. ("Over the Glacial Wilderness," Moscow, Vodnyy Transport, 30 Oct 58)

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