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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.

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I. GENERAL

Some Soviet IGY Achievements Reviewed at Academy of Sciences USSR Meeting

At the annual meeting of the Academy of Sciences USSR which began on 25 March, V. V. Belousov, corresponding member of the Academy of Sciences USSR and deputy chairman of the Soviet IGY Committee, spoke in detail on the great work being conducted under the IGY program by the USSR. According to the volume of its contribution, the Soviet Union has assumed first place in the IGY. On the suggestion of Soviet scientists, two world centers for the collection, storage, and dissemination of IGY materials were organized. One such center is located in Moscow and the other in Washington.

In his speech, V. G. Bogorov, Doctor of Biological Sciences and director of the oceanological expedition on the Vityaz', spoke on investigation in the oceans which were conducted by the Academy of Sciences USSR. Works was done in the Atlantic, Indian, and Pacific oceans and in Antarctic waters. During one of the Vityaz' expeditions, a new submarine mountain and new currents were discovered, and unknown species of animals were found. Many deep-water depressions were studied. The Soviet Union now has taken the first place in this branch of science. The study of 14 deep-water depressions in the Pacific Ocean led to new discoveries. For example, as was revealed, today, in these depressions, live such species of animals which, it seems, vanished millions of years ago.

Academician V. A. Ambartsumyan spoke on the achievements of Soviet astronomy and Soviet Astrophysics. Astrophysics, he said, in the past decade, has turned into one of the most important contemporary natural sciences. The launching of artificial Earth satellites has uncovered for this science the prospects of research by new methods. The Congress of the International Astronomical Union, which will be held in Moscow in August, should be a major scientific event in 1958. (Moscow, Izvestiya, 27 Mar 58)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Launching of Sputnik III Termed Imminent

Magyar Ifjusag, central newspaper of the Hungarian Communist Youth Federation, received in Vienna on 2 April, published an interview in which Prof K. P. Stanyukovich, "Soviet rocket expert," announced that the "launching of Sputnik III is imminent." Professor Stanyukovich asserted that "It will be larger and heavier than Sputnik II, and we have several dogs trained," but he did not specify if the Soviets plan to send more than one dog into space. The professor also revealed that the Soviets are experimenting with nuclear-powered rockets.

Nepszabadsag, organ of the Hungarian Communist Party, has published an article to the effect that "Soviet experts believe that it is possible to place a satellite in orbit around the Moon using Sputnik II's rocket." However, "they believe that no instruments could be placed in such a small satellite and that launching such a satellite would be only a propaganda move. It is therefore probable," added the newspaper, "that the next sputniks will weigh from 500 to 1,000 kilograms and that only later will a rocket with a satellite be launched to the Moon." (Brussels, La Libre Belgique, 3 Apr 58)

Preliminary Results of Sputnik Experiments Reported to Academy of Sciences

Academician A. V. Topchiyev, chief scientific secretary of the Academy of Sciences USSR, has reported the preliminary results of sputnik experiments to the annual meeting of the academy which began on 25 March and lasted several days. Pravda has published the full text of that part of Topchiyev's speech dealing with satellite experiments as follows:

One of the interesting geophysical results obtained from an analysis of the movements of the satellites is the determination of the density of the atmosphere. Analysis of the observed change in retardation of the satellites makes it possible to clarify and evaluate the latitudinal and diurnal variations in density.

From a number of ionosphere measurements, the determination of the electron concentration of the outer ionosphere according to observations of the radio signals of Sputnik I should be noted. The exact times of radio fade-in ("radiovoskhod") and radio fade-out ("radiozakhod") of the satellite signals were determined.

The results of satellite radio signal observations received on 40 megacycles at six stations on 5, 6, and 7, October were processed. Computations were made with the aid of the BESM high-speed electronic computer.

The data obtained on the electron concentration have made it possible to determine more precisely the distribution of the density of neutral particles at the various heights at which the satellites moved. From the results of the measurements, the conclusion can be drawn that beginning at an altitude of 2,000-3,000 km, the density of neutral particles approximates the density of interstellar gas. This has a fundamental significance for ionospheric physics.

Radio observations of the satellites have made it possible experimentally to check the possibility of determining the parameters of the satellite orbit by the Doppler effect. For increasing accuracy, observations were made of the 40 megacycle signals which, to a lesser degree, are subject to the influence of the ionosphere and where the Doppler effect is stronger.

Observations of the signals of the first Soviet satellites show that the Doppler effect can be used successfully for determining the parameters of the satellite's orbit.

Measurements of the intensity and variations of the intensity of cosmic rays were made by Sputnik II. Processing of the results of observations permit clarification of the relation of the number of particles to altitude. In the altitude range from 225 km to 700 km, up to an increase up to 40 percent in cosmic ray intensity dependent on a basic lessening at high altitudes of the effect of the Earth's magnetic field on cosmic radiation was observed.

Data was also obtained on the number of cosmic ray particles at different latitudes and longitudes. Analysis of these results led to the conclusion that lines of equal intensity of cosmic rays do not coincide with geomagnetic parallels.

Thus, there is a significant discrepancy between the characteristics of the Earth's magnetic field, obtained, on the one hand, with the aid of cosmic rays and, on the other, by measurements of the magnetic field on the Earth's surface.

Observations of cosmic rays by the satellite gave evidence of the variations of the intensity of its radiation. These variations evidently are connected with the condition of the interplanetary medium near the Earth. One case of a sharp rise to 50% of the number of particles of cosmic radiation was observed. Excellent agreement of readings of both instruments exclude the possibility of explaining this case as due to errors in the apparatus. At the same time, cosmic ray ground stations did not detect a substantial increase in cosmic ray intensity at this time. At present, a detailed study of this occurrence is being made. It is possible that they are caused by a new phenomena, namely, by generation of cosmic rays of very low energy on the Sun which are strongly absorbed by the Earth's atmosphere.

The most unique experiment on Sputnik II was the verification of the possibility of survival of a living organism under conditions of cosmic flight. The purpose of the investigations was to study the conditions of basic physiological functions of an animal during various stages of flight of the satellite.

The behavior and condition of the animal during the most difficult stage of satellite flight (the launching and entry into orbit) from the biological viewpoint is of great interest. The motion of the satellite was accelerated, and the magnitude of the acceleration exceeded gravity acceleration several times. Simultaneously with the action of acceleration, the effect of vibration and noise of the operating engine of the rocket on the animal were shown.

Interpretation of the data indicated that immediately after launching, the frequency of cardiac contractions increased approximately three times in comparison with the initial frequency. Later on, when the action of a acceleration not only continued but also increased, the frequency of heart beats decreased. Analysis of the recordings of biological currents of the heart (electrocardiogram) did not reveal any symptoms. A typical chart of heart beat repetition, so-called sinus tachycardia, was noted.

According to the measure of increase in the apparent weight of the body of the animal, respiration became more shallow and frequent. At the peak of the effect of acceleration, the frequency of respiration exceeded the initial frequency three to four times.

Analysis and comparison of the obtained data with the results of previous laboratory experiments make it possible to conclude that the animal endured the flight of the satellite from launching to orbit entry with complete satisfaction.

During subsequent movement in orbit, the animal was placed in a state of dynamic weightlessness. The respiratory rate decreased, the frequency of cardiac contractions continued progressively to decrease and return to the original [normal] value.

Analysis of the electrocardiograms recorded during that time disclosed certain changes in configuration of its elements and the duration of separate intervals. The electrocardiogram chart reflected transient neuro-reflector shifts in the regulation of cardiac activity. In spite of the unusual condition of weightlessness, the respiratory activity of the animal was moderated.

Normalization of functional indicators of blood circulation and respiration during the period of weightlessness testifies to the fact that this peculiar factor by itself did not cause any substantial and persistent changes in the condition of the physiological functions of the animal.

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These are only preliminary results but they show that artificial satellites are powerful instruments for scientific research. It should be noted that, together with satellites, in connection with the IGY program, various types of rockets are being used in our country for geophysical investigations.

If a satellite provides the invaluable opportunity for conducting prolonged measurements of various parameters in different regions of the globe, then high-altitude rockets make it possible to obtain a vertical profile of the atmosphere through its entire depth.

Using the achievements of Soviet reactive technology which makes it possible to launch and place in orbit containers with scientific apparatus weighing many hundreds of kilograms, our scientist can now raise very different problems in the investigation of the upper layers of the atmosphere and in the cosmic space region closest to the Earth. It is clear, also, that the solution of problems of future flights in cosmic space and attainment of other planets lies only in creating satellites of great weight. (Moscow, Izvestiya, 26 Mar 58)

Photograph of Camera Used by Soviets in Tracking Sputnik

The mounting of a camera for photographic observations of artificial Earth satellites has been completed at the Tashkent Astronomical Observatory, according to a caption to a photograph appearing in Pravda. With the aid of such a camera, the time of passage of a satellite can be determined with a high degree of accuracy.

The photograph in Pravda shows Prof V. P. Shcheglov, corresponding member of the Academy of Sciences Uzbek SSR and director of the Tashkent Astronomical Observatory, and A. A. Latypov, Candidate of Physicomathematical Sciences and a senior scientific associate, preparing the new camera for photographic observations of the artificial Earth satellite. (Moscow, Pravda, 26 Mar 58)

Sputnik II Visible in Moscow on 25 March

Many thousands of residents of Moscow flocked into the streets to see Sputnik II on 25 March 1958 as it passed overhead from southwest to northeast at 1952 Moscow time. (Moscow, Pravda, 26 Mar 58)

East German Observatories Tracking Earth Satellites With Soviet Equipment

The Sonneberg Observatory is making preparations to track artificial earth satellites with the utmost accuracy. About ten observers each are to lay "optical barriers" across the sky with their telescopes in two different directions. Twenty small telescopes, which were developed by the Astronomical Council of the Academy of Sciences USSR, are available for this purpose. Other East German observatories also received these small telescopes, which possess great light intensity and a wide visual field. (Suhl, Freies Wort, 28 Jan 58)

Soviet Investigations of Upper Layers of Atmosphere and Record High-Altitude Geophysical Rocket

On 27 March 1958, the Soviet IGY Committee announced in Pravda the successful launching on 21 February 1958 of a single-stage geophysical rocket to a new world record-breaking altitude of 473 kilometers. Under the general heading of "Soviet Investigations of the Upper Layers of the Atmosphere With the Aid of Rockets," Pravda devoted 1-1/3 pages to the Soviet IGY Committee's announcement, and articles "New Important State of Research"; "Program of Methods and Investigations"; "Ascent of a Soviet Rocket to an Altitude of 473 Kilometers," "Brief Results of Investigations Conducted on Geophysical Rockets." The latter includes a discussion of air pressure, composition of the ionosphere, investigation of micrometeors, concentration of electrons in the ionized layers, and biological investigations during flights in the upper layers of the atmosphere.

The Pravda articles are accompanied by six photographs showing: (1) launching of a Soviet geophysical rocket to an altitude of 212 kilometers; projecting instrument canisters are visible on the side of the rocket; (2) launching of the Soviet Geophysical rocket on 21 February 1958; canisters with research apparatus are visible in the forward section of the rocket; (3) canister with geophysical apparatus after descent from an altitude of 212 kilometers; (4) ionization and magnetic manometers undergoing a check-out before installation on the rocket; (5) dispersion radio-frequency interferometer; and (6) canister with apparatus and experimental animals after a successful descent from an altitude of 212 kilometers. In the foreground is "Modnitsa," the dog which has just returned from a flight.

The full text of the Pravda articles follows:

1. Soviet IGY Committee Announcement

"The Soviet IGY Committee has reported on the launching in the USSR of a geophysical rocket to an altitude of 473 kilometers.

For a number of years, the Soviet Union has been conducting a study of the upper layers of the atmosphere and the phenomena occurring in cosmic space with the aid of high-altitude research rockets.

"Launchings of geophysical and meteorological rockets are conducted systematically to altitudes of from several tens to 200-210 kilometers.

"In carrying out the program of the IGY, on 21 February 1958 at 1142 hours, Moscow time, a single-stage geophysical rocket, which attained a record altitude of 473 km, was launched from the territory of the European part of the USSR in the middle latitudes. Geophysical instruments for comprehensive investigations of the upper layers of the atmosphere were installed on the rocket. The total weight of geophysical scientific apparatus, radio telemetering devices, power supplies, and auxiliary systems, together with the instrument container, was 1,520 kg.

"The following geophysical instruments were installed on the rocket: (1) an ultra-short wave dispersion radio interferometer for measuring the concentration of free electrons in the ionosphere; (2) an instrument for measuring the ion composition of the atmosphere; (3) an apparatus for studying the concentration of positive ions in the atmosphere; (4) an instrument for measuring electron temperature; (5) ionization and magnetic manometers for measuring air pressure; (6) instruments for recording the impact of micrometeor particles; and (7) a solar spectrograph for recording the ultraviolet region of the spectrum.

"The rocket was stabilized during the entire course of its flight, including its launching stage, with the aid of special devices that prevented its rotation around vertical and horizontal axes. This circumstance considerably increases the accuracy and value of the scientific investigations being conducted.

"The flight of the rocket was made from a small angle to the vertical in a specified direction, after which the rocket landed precisely in a predetermined area.

"A preliminary examination of the materials obtained indicated that the apparatus operated satisfactorily during flight.

"As a result of this ascent of the geophysical rocket, conducted on 21 February 1958, the distribution of the concentration of free electrons in the ionosphere to altitudes of 473 km was obtained for the first time. The distribution of air pressure to an altitude of 260 kilometers had been recorded previously. The collision of the rocket with micrometeors has been noted and a number of other geophysical measurements have been made. The data obtained is being processed."

2. A New Important Stage in Research

"Scientific investigations of the upper layers of the atmosphere and the phenomena occurring in the region of cosmic space closest to the Earth has been conducted in the USSR for a number of years with the aid of rockets. The first ascent of a research liquid-motor rocket was accomplished in the USSR in 1933.

"Since 1949, the launching of rockets equipped with scientific apparatus, gradually became one of the basic means for studying the upper layers of the atmosphere in the USSR. In May 1949, the first vertical launching of a rocket to an altitude of 110 kilometers was conducted. An entire series of rockets of this class was launched. In the first of these rockets the weight of scientific apparatus comprised a total of 120-130 kilograms.

"With each new launching the program of scientific investigations was expanded and new apparatus was used. The weight of scientific apparatus on rockets launched in recent years attained a total of 1,500 kilograms. It should be noted that in some launchings of geophysical rockets the simultaneous recovery by parachutes with favorable landings on Earth of five compartments and containers with scientific apparatus and experimental animals was accomplished.

"A new stride in research of the upper layers of the atmosphere manifested itself with the creation of a rocket which in May 1957 with experimental apparatus with a general weight of 2,200 kilograms attained an altitude of 212 kilometers. In this case, the scientific research apparatus and the experimental animals were successfully returned to Earth. An entire series of such flights was accomplished. The year 1958 is marked by new achievements in the field of research of the upper layers of the atmosphere thanks to the creation of a more powerful single-stage geophysical rocket which, on 21 February 1958, with scientific apparatus having a total weight of 1,520 kilograms ascended to an altitude of 473 kilometers and established a world altitude record for a rocket of this class."

3. Program and Methods of Research

"A great number of launchings of geophysical rockets for scientific research purposes is stipulated under the IGY program. The rockets should be launched according to a specific plan from various points of the globe -- in the Arctic, in the middle latitudes of Europe, Asia, America, Australia, in the oceans and Antarctica. The launchings are being accomplished by scientific institutions of the USSR and a number of other countries.

"Soviet scientists are conducting investigations with rockets at three points: in the Arctic (on Franz Josef Land, in the middle latitudes), in the European part of the USSR, and in Antarctica in two areas (near Mirnyy Observatory and in the ocean aboard the Ob').

"The locations of rocket launchings, as in the case of the position of the orbit of the satellite launched from the USSR, were selected to obtain characteristics of the phenomena being studied in various regions of the globe and above all at different latitudes.

"The use of satellites and rockets for geophysical research has its own peculiarities. The placement of scientific apparatus on a satellite provides us with an invaluable possibility for conducting measurements for a prolonged period of time over various areas of the globe. In addition, it is necessary to consider the fact that the orbit of the satellite should be placed no less than 200 kilometers in order that its lifetime would be sufficiently long. In this connection with atmosphere in the region lying below 200 kilometers cannot be studied with the aid of satellites.

"A satellite launched into its orbit possessing considerable ellipticity, passes through different altitudes in the atmosphere; however, at every latitude the satellite is only at two altitudes (corresponding to the two directions of its movement -- direct and reverse). At different altitudes, the satellite passes over different geographic regions, to obtain an altitude profile of the atmosphere (that is, to fix these or those properties of the atmosphere at one time at various altitudes) in one and the same geographic region with the aid of satellites is impossible. This is why the launchings of high altitude geophysical rockets are an important part of atmosphere research, together with the development of geophysical research with the aid of artificial satellites.

"A combination of data obtained during investigations with rockets and satellites and also with the aid of various indirect methods (ionosphere sounding, meteor studies, aurora studies and others), permits the obtaining of a correct notion on the different processes themselves which occur in the upper layers of the atmosphere.

"Great attention in Soviet works is given to the recovery of scientific instruments and experimental animals raised in rockets, to the appropriate positioning of apparatus on the rockets themselves, and also to the special containers which are separated from the rockets for the purpose of guaranteeing the greatest accuracy in the experiment. The basic problems of scientific research, which will be worked out by rockets during the IGY in the USSR, are the determination of the temperature, pressure and chemical composition of the atmosphere at various altitudes, a study of the properties of the ionosphere concentration of ions and electrons, electron temperature and others, the investigation of cosmic rays, the study of short-wave ultraviolet part of the solar spectrum, and a study of micrometeors.

"In the period of the IGY just past, launchings of rockets of various types and designations were conducted. At the high-latitude observatory on Kheys Island (Ostrov Kheysa), Franz Josef Land, located at 80-31 North latitude, investigations of the atmosphere by means of vertical launchings of meteorological rockets are being conducted. Six rocket launchings have been made on Kheys Island up to the present time. The rockets are launched to the zenith. During flight, the container with instruments for measuring temperature and air pressure is separated from the rocket and is exposed to the air for 40 minutes -- in the beginning rising upward, then floating down by parachute. The results of measurement are transmitted from on board the rocket to Earth by radio telemetry.

"The first launching of a research rocket in the Antarctic was made from aboard the expeditionary ship Ob' in the Davis Sea in the region of the South Polar Antarctic Observatory, Mirnyy, in December 1957. Other rocket launchings were made from the ship in the sea along the Ob's expeditionary itinerary along the coast of Antarctica eastward from Mirnyy observatory. To the present time, four launchings have been made from the Ob'. As a result of the rocket soundings of the atmosphere conducted in the Arctic and Antarctic, data on the distribution of temperature and pressure of the air in middle altitudes in these regions have been obtained for the first time. During the IGY, future rocket launchings will be conducted here."

4. Ascent of a Soviet Rocket to an Altitude of 473 Kilometers

"The launching of a Soviet geophysical rocket on 21 February 1958 in which the apparatus was raised to an altitude of 473 kilometers is an important stage in upper atmosphere research. Not only because of the altitude achieved, but also because of the broadness of the scientific program accomplished during the launching, this ascent considerably exceeds experiments on upper atmosphere research with rockets conducted to this time in the USSR and other countries. A great number of different kinds of apparatus were installed on the rocket. The measurement of air pressure was made with the aid of ionization and magnetic manometers; special piezo electric transducers recorded the energy and the number of micrometeors colliding with the rocket; special dynamic electrometers recorded the voltage of the electrical field on the surface of the rocket. The ion composition of rarefied gases in the upper layers of the atmosphere were determined with a radio-frequency mass-spectrometer.

"Ion traps mounted on the surface of the rocket measured the concentration of the positive ions and the measurement of the electron temperature was made by means of sounding characteristics. The concentrations of electrons in the various regions of the ionosphere were measured by a dispersion interferometer. A spectrometer, mounted on the rocket, photographed the solar spectrum in the short-wave ultraviolet region.

"It should be noted that during the course of the entire flight, including the launching stage, the rocket was stabilized with the aid of special devices that prevented its rotating around the vertical and the horizontal axes. This considerably increased the accuracy and value of the scientific investigations being conducted.

"A careful determination of the trajectory of the rocket with the aid of appropriate optical and radio measuring apparatus made it possible to determine the altitude at which the various measurements were made. The results of the measurements were transmitted to ground recording stations by radiotelemetry or were recorded on board the rocket on tape which was subsequently recovered.

"The total weight of the scientific instruments, radio telemetering apparatus, power supplies and auxiliary systems together with the instrument container was 1,520 kilograms."

5. Brief Results of Investigations Conducted With Geophysical Rockets

a. Air Pressure

"Clarification of the laws of distribution of pressure, density, temperature, and the composition of the Earth's atmosphere at an altitude is one of the most important tasks in atmospheric physics. To the present time, direct measurements of pressure were made with rocket launchings to altitudes of 160 kilometers and the density of the atmosphere to 220 kilograms. Only very general and, in a large measure, conflicting ideas on relatively high altitudes have existed until recent times. An analysis of the movement of the Soviet artificial Earth satellites made it possible to obtain data on the distribution of the density in the atmosphere to several very high altitudes. However, only direct measurement of air pressure in the upper layers with the aid of rockets and satellites will make it possible to obtain sufficiently accurate data. During rocket investigations of the atmosphere for measuring pressure, membrane, heat, magnetoelectric discharge, ionization, and other types of manometers were used. The usual magnetic manometers were suitable for measuring pressure in a range 10^{-2}-10^{-5} millimeters of mercury.

"Pressure of around 5.10^{-8} millimeters of mercury can be measured with ionization manometers of the usual design. In subsequent investigations ionization and magnetic manometers were used making it possible to measure pressure to 1.10^{-9} millimeters of mercury. The currents of manometers proportional to the pressure, are amplified by amplifiers and are put into the input of a radio telemetering system. The manometers themselves are mounted on the outside of the hermetically sealed instrument container on the rocket and through special vacuum devices are connected with the amplifiers. The glass tubes of the manometers located on the outside are protected by special metallic cases. During ascent to a specified altitude these cases are ejected and the tubes of the manometers are uncovered and exposed to the external surroundings. Values of pressures are continuously transmitted by telemetering apparatus to ground receiving stations. The unchanging position of the rocket body during its ascent makes it possible to take into account errors originating during measurement of air pressure as a result of aerodynamic causes, and to make the appropriate corrections during the processing of results. With the aid of the apparatus described, measurement of pressure to an altitude of 260 kilometers were made not only during ascent but also during descent of the container. A pressure up to 10^{-7} millimeters of mercury were recorded.

b. Composition of the Ionosphere

"The composition (both neutral and ionized molecules) of the atmosphere and ionized molecules at great altitudes was not known. In raising of special flasks for taking air samples, it was possible to determine the composition of the atmosphere to an altitude of around 100 kilometers. To select an air sample from a high altitude which is suitable for analysis is difficult for many reasons; therefore, it becomes necessary to use different methods here.

"The mass spectrum of positive ions was analyzed with the aid of a mass spectrometer mounted in the container which was raised to an altitude of more than 200 kilometers. A small-size light instrument specially designed for this purpose was used. The transducer of the instrument, which is a mass spectrometer receiver directly exposed to the atmosphere, the remaining apparatus, and a power supply were located within the container. A radio telemetering system with the aid of which data on the mass spectra and information on the operation of the instrument necessary for decoding the recordings were transmitted to Earth, were also located in the container.

"A study of the radio telemetric recordings indicated that the instrument operated normally during the entire flight. Data on the ion composition was obtained at altitudes of 105-206 kilometers. The results of the experiment indicate that at these altitudes ions with a mass number of 30 predominate (presumably nitrogen oxide ions).

"In the upper part of the trajectory, ions with a mass number of 16 (presumably ions of atomic oxygen) were also recorded. Data was obtained on the distribution of ions of these masses at an altitude and layers with increased ion concentrations were recorded.

c. Investigation of Micrometeors

"The study of micrometeors entering the atmosphere from outer space are of great interest, not only for geophysicists but also for the solution of purely practical problems -- guaranteeing the safety of movement of rockets and artificial Earth satellites in interplanetary space.

"The determination of the concentration of meteor particles and their energies is most important. For this purpose apparatus consisting of piezo-electric transducers mounted on the plating of the rocket, and an electron apparatus designed for converting electrical voltage coming from the piezo transducer in the form of short period attenuating oscillations in the signal of the radio telemetering system is mounted on the rockets.

"In the 21 February experiment barium titanate was used as the piezo transducer and was placed under a membrane made from stainless steel. The transducers were mounted in four places on the perimeter of the rocket in its nose section and occupied a total area of 900 square centimeters. Upon impact of a microparticle an attenuating electrical oscillation is generated by the transducer. The amplitude of these oscillations depend on the energy of the striking particle. In the experiment described here the motion of micrometeors to an altitude of 300 kilometers was reliably recorded. In the ascent of the rocket from 125 kilometers to 300 kilometers, a total of 268 collisions of micrometeors with the surface of the transducers was recorded, in which case, 44 collisions occurred at altitudes from 125-250 kilometers for one square meter of surface, higher -- to 300 kilometers -- 9 impacts per square meter occurred.

d. Concentration of Electrons in the Ionized Layers

"In the area of the atmosphere located above 50-60 kilometers, there are a considerable number of free charged particles as a result of which they exert a strong influence on radio wave propagation. One of the basic characteristics of this region, called the ionosphere, is the electron concentration -- the number of free electrons per cubic centimeter. Depending on the magnitude of the electron concentration, the speed and trajectory of radio wave propagation changes. Until the beginning of rocket investigations of the upper atmosphere, the electron concentration at various altitudes was determined by indirect methods with the aid of reflections from the ionosphere of radio waves of various frequencies, which were radiated from the Earth. From an analysis of these measurements, it was found that at altitudes of approximately 100-120 kilometers and 250-300 kilometers, there is maximum ionization as a result of which it was supposed that the ionosphere consists of a number of layers (E-layer at around 100 kilometers F-layer at around 250 kilometers).

"However, it was too difficult to study the region lying between the E and F-layers by these indirect methods, and it is impossible perfectly to study the region of the ionosphere lying at the maximum electron concentration of the F-layer. This occurs because of the fact that if the maximum electron concentration of the F-layer corresponds to a certain frequency of radio waves reflected from it, then during an increase of the frequency the radio wave is not reflected from the ionosphere and passes into outer space.

"The study of the ionosphere from the Earth played a vast role in the matter of guaranteeing long-distance radio communications (possible only with the aid of radio waves reflected from the ionosphere). However, for successful radio communications with apparatus for flights into cosmic space and for various radio measurements connected with such flights it is necessary to know the characteristics of all depths of the ionosphere.

"The use of rockets carrying scientific apparatus directly into the ionosphere, permits the conduct of measurements of the characteristics of the ionosphere by new methods in the regions inaccessible to investigations from the Earth's surface.

"The majority of measurements conducted till now have to do with altitudes to 200-250 kilometers lying below the maximum ionization of the F-layer. These measurements change substantially from the point of view of the structure of the ionosphere in this region. It has been established that the idea concerning the existence at altitudes of 110-120 kilometers of a sharply defined E-layer is incorrect. Actually at the maximum electron concentration in the region 100-120 kilometers there follows a region in which the ionization is changed only insignificantly and smoothly passes on to increase in the region of the F-layer.

"These results were obtained in the USSR during the time of a series of launchings of high-altitude geophysical rockets by the Academy of Sciences USSR for 1957 and also in the USA in the works of the Naval Research Laboratory. As to the regions of the ionosphere lying above the maximum F-layer (the so-called "external ionosphere"), up until recently the only known data on the distribution of the electron concentration in this region were the results obtained in the US by Berning from the launching of a two-stage rocket consisting of the German V-2 and the Wac-Corporal which achieved an altitude of around 380 kilometers.

"According to this data, at the maximum of the F-layer located at the time of the experiment at an altitude of 300 kilometers, the electron concentration fell off sharply, decreasing almost to zero at an altitude of around 380 kilometers. These results to the present time are usually cited in all geophysical literature.

"At the time of the vertical launching of the Soviet geophysical rocket on 21 February 1958, new measurements of the electron concentration were made. These measurements, successfully made throughout the entire trajectory of the rocket, gave results the processing of which in the future will make it possible to obtain a detailed distribution of the electron concentration to altitudes of 470 kilometers which is almost 100 kilometers more than the maximum altitude in Berning's experiment.

"More important, however, is the fact that the results obtained differ significantly and principally from Berning's results even though the time of day, time of year, phase of the cycle of solar activity during the time of the measurements makes these two experiments completely comparable.

"At an altitude of 470 kilometers, the measured electron concentration was equal to a million electrons per cubic centimeter, whereas in the American experiment, the electron concentration was insignificantly small even at an altitude of 380 kilometers. The result obtained, testifying to the very slow decrease of electron concentration at the maximum of the F-layer, is new.

"Since the concentration of neutral particles at altitudes of around 500 kilometers, according to existing notions, only slightly (slightly more than is in order) exceeds the revealed concentration of free electrons at these altitudes, then we must assume that there is an intensive diffusion of charged particles from the more dense lower-lying regions of the ionosphere. This is of considerable interest for understanding the physics of the phenomena in the external ionosphere. The methods of the experiments with whose aid the aforementioned results were obtained are based on the idea of a so-called dispersion interferometer proposed by Soviet scientists Academician M. I. Mandel'shtem and N. D. Papaleksi in 1937.

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"From on board the rocket during flight, radiowaves are radiated which are strictly linked in phase and which are received on the Earth by special stations. Continuous recording of the difference of the phases of signals received from on board the rocket and simultaneously conducted measurements of coordinates of the rocket make it possible to determine the distribution of the electron concentration in the ionosphere at an altitude.

"A feature of the described experiment by comparison with experiments conducted within the US using, similar methods, is the use of much shorter waves. This makes it possible significantly to decrease the effect of the Earth's magnetic field on the results of measurements.

e. Biological Investigations During Flights in the Upper Layers of the Atmosphere

"Man's mastery of cosmic space, in addition to the purely scientific and engineering design problems, requires the solution of a number of medical and biological problems. This may be achieved by means of preliminary study of the effect of factors of cosmic flight on the organism of animals, and also by the development of means guaranteeing their normal vital activity during flight, a successful landing, and, as required, recovery.

In the Soviet Union since 1949, a broad scientific research work has been conducted to solve these problems. In the first stage, Soviet scientists conducted investigations in which the experimental animals (dogs) accomplished flights in rockets to altitudes of 100-210 kilometers. It was shown that in hermetically sealed cabins of regenerative type there is complete provision of the necessary barometric pressure, temperature, and normal composition of the air for the entire course of the flight, in which the duration of existence of two animals in a cabin is for 3 hours.

"For investigating the condition of the animals during the time of the flight, the necessary apparatus for recording blood pressure, respiration, pulse, biological currents of the heart, behavior of the animal, temperature and air pressure in the cabin, acceleration, etc., were developed. The return of the animals to earth was accomplished by means of separating the hermetically sealed cabin from the rocket and its subsequent descent by parachute.

"Recorded data obtained of the behavior and the basic physiological functions of the animals made it possible to conclude that acceleration originating during flight of the rocket and the entry of the separated cabin into the denser layers of the atmosphere, descent and also the state of weightlessness for a period of from 3.5 to 6 minutes, certain other factors of flight being equal, are completely bearable and did not cause any kind of noticeable changes in the condition of the experimental animals. Certain animals accomplished flight in the upper layers of the atmosphere repeatedly; however, even under these conditions no changes of any kind in the condition of their health both after flight and during the course of prolonged subsequent period of observation were revealed.

"The positive results of the investigations conducted made it possible for us to study the possibility of abandoning a rocket by a method of catapulting with subsequent descent of the animals and the instruments to Earth.

"For this purpose, in the second stage of investigations, special high altitude (without oxygen masks) suits which provided the animals satisfactory conditions of existence both in the cabin of the rocket and during descent from high altitudes and under high velocities of flight, were used. The required amount of air pressure in the suit and the oxygen content were maintained by special oxygen devices.

"Catapult devices provided a safe abandonment of the rocket at altitudes to 110 kilometers and a flight velocity of around 1.2 kilometers per second.

"In the experiment, special attention was paid to working out the recovery of animals under the most complex conditions:

"In the descending trajectory during unstabilized rocket flight, parachute systems in one of the cases were introduced into action immediately after catapulting at an altitude of 85-75 kilometers and in the other cases catapulting was accomplished at an altitude of 39-46 kilometers and the opening of the parachute occurred at an altitude of 4 kilometers (delayed drop).

"During abandonment of the rocket at an altitude of 85-75 kilometers, the time of descent of the animals to Earth was more than an hour. At the same time, no harmful effects to the health of the animals during the catapulting, parachuting, and flight in the upper layers of the atmosphere was disclosed.

"Analagous data was obtained even from observation of the animals who were ejected several times from rockets with the aid of catapults.

"Investigations conducted showed that the operation of the system providing safe flight: a suit, catapult devices, parachutes, automats in complex and different conditions of the experiments -- were shown to be entirely efficient and guaranteed safe landing of the animals.

"At present, many years of observation of experimental animals have accumulated, including projects in which the animals completed flights in the upper layers of the atmosphere repeatedly. No kind of unfavorable effects of the flights were revealed in the condition of these animals.

"Thus, as a result of the work conducted physiological effects of various factors and characteristics typical for flight in the upper layers of the atmosphere were investigated, the consequences of their effect were studied, means were developed for guaranteeing optimum conditions for animals in rocket flight, and also methods of recovery designed for conditions in emergency situations were developed."...

"Contemporary development of Soviet rocket engineering permits the solution of many tasks in the investigation of the upper layers and regions of the atmosphere and cosmic space with the aid of rockets. This is clearly evident from the example of the launching of the first artificial Earth satellites in the world by the Soviet Union which were placed with the greatest accuracy in their orbit at a great altitude above the surface of the Earth.

"A feature of Soviet geophysical rockets and artificial satellites is the considerable weight of their pay-load, achieving, for example in the second satellite, more than 500 kilograms of scientific research apparatus.

"In increasing this weight to several kilograms, it may be possible to accomplish flight even to the natural satellite of our planet, the Moon, which is located at a distance of 384,385 kilometers from the Earth. However, the scientific significance of such an experiment would not be great, mainly because of the impossibility, considering the economy of weight of having on board such a rocket any serious apparatus for conducting scientific research, for recording of obtained results and their transmission to Earth. With the future development of rocket engineering, the problems of achieving the Moon and the conduct of serious scientific investigations connected with this may be accomplished in several years.

"The possibility of a rapid solution of the problem of interplanetary flights, which in no way can be solved with the aid of satellites of microscopic dimensions whose utilization for scientific purposes is limited, lies mainly in creating artificial satellites of great weight.

"Investigations of the upper layers of the atmosphere with the aid of rockets systematically conducted by Soviet scientists gave valuable scientific results. The launching of a Soviet geophysical rocket to an altitude of 473 kilometers is an important new stage in research conducted according to the program of the International Geophysical Year." (Moscow, Pravda, 27 Mar 58)

III. COSMIC RAYS

Automatic Recording of Cosmic Flares

An article titled "Automatic Recording of Flares of Cosmic Radiation," by Ya. L. Blokh and L. N. Korablev, of the Scientific Research Institute of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation, gives a description of an instrument for the automatic recording of cosmic flares, using a three-dimensional (cubical) telescope designated for continuous registration of the intensity of cosmic radiation within the program of the IGY. The instrument affords the possibility of determining, within half a minute, the time of the beginning of a 5 percent, or better, increase of the intensity of the mu-meson component by means of a discrete comparison of intensity against a standard.

The telescope comprises three rows of measuring devices with 10-cm lead shields between the second and third rows; the instrument thus consists of two independent devices (two cubicles). The coincidences of impulses from the first, second, and third rows are caused by the hard component. Besides triple coincidences, double coincidences of the first and second and the second and third rows are recorded. These coincidences are caused by the ordinary and the hard components in the wide solid angle ("semisolid geometry") and afford the possibility of determining the soft component. The beginning of solar flares is determined according to two coincidences (first and second rows) which record the over-all component. This increases the statistical accuracy and the accuracy of the fixing of the beginning of the flare, since the number of coincidences (1-2) is 2.4 times greater than the number of coincidences (1-2-3). Furthermore, the coincidences (1-2) record the over-all component, which is obviously more sensitive to solar flares than the hard component. In the summation of the number of double coincidences from two cubicles, the total number of impulses is increased up to 240,000 per hour, which provides a statistical accuracy of plus-minus 2.2 percent for 0.5 minute.

In contrast to the usual system with uninterrupted accumulation of impulses and amplitude selection of the signal, this instrument has a better stabilization of the threshold of operation, since the measured radiation is compared with the frequency of a standard generator with a stabilization of 0.1-0.01 percent. The comparison is made by means of a discrete calculation of the impulses of the radiation and the impulses of the generator with a reversible ring counter RSK-1g (illustrated). The compared impulses are fed to two different inputs, one for the direct and one for the reverse count. The measuring device operates with cold cathode tubes stabilized by the initial silent discharge. In the ring, only one tube can glow. The alternate incoming impulse activates either the next following tube in the ring order, or the preceding tube, depending on which input is fed. The sequence of the operation of the tubes is guaranteed by the detectors. The particular tube (numbered) which happens to be glowing indicates the difference of the quantity of impulses occurring at both inputs. To reduce the capacitance of the measuring device, the two inputs are connected after the recounting circuits PK-1,000 and PK-6, which operate with cold cathodes. The reverse counter circuit is interrupted after the tube numbered zero. Consequently, when there is a normal intensity of the cosmic radiation, which is somewhat lower than the frequency of the standard generator, the measuring device reverts to the original state, because it decreases its indication only up to the moment of operation of the zero tube. Any further admission of impulses does not change this level, which guarantees the uniformity of sensitivity of the system to the flare.

When the intensity of the radiation becomes greater than the assigned level, all the tubes of the reverse counter and the output tube operate in sequence, which connects the device which photographs the reading of the instrument. At the same time, the timing relay releases, interrupting the measuring device for 1-2 minutes, so that, during larger flares, excessive photographing will not take place. The variations of the intensity are determined by readings of the counting units of the instrument, and by readings of simultaneously photographed clocks.

The threshold of operation of the entire system can be regulated by changing the frequency of the standard generator. By varying the capacitance of the reverse counter, it is possible to regulate the statistical accuracy and the operating time within wide limits. (Pribory i Tekhnika Eksperimenta, No 5, Sep-Oct 57, pp 58-59)

IV. GEOMAGNETISM

Method of Registering Short-Period Variations of Earth Currents

One of the problems specified by the program of geophysical investigations during the International Geophysical Year is the study of short-period geomagnetic and geoelectric variations which are one of the forms of disturbances of the Earth's electromagnetic field.

A method of high-speed registration of earth currents by utilizing a capacitance coupling of the electrodes and of the galvanometer is described in a periodical article by V. G. Dubrovskiy, Institute of Physics and Geophysics, Academy of Sciences Turkmen SSR.

The detailed study of the nature of short-period oscillations is difficult and sometimes impossible, especially for oscillations with a period of less than 10 seconds because of the relatively low scan speed (20-90 mm/hour) used at present in the majority of geophysical stations. Further, an increase in the scan speed by the usual method of recording leads to an objectionable increase in the use of film. Therefore, at present, in the study of short-period oscillations of earth currents a method is used by which the connection between the electrodes is accomplished through a capacitance, and registration is made by using a spiral scan. This permits the film speed to be increased without increasing the amount of film used. In addition to this, the short-period variations of earth currents are filtered by the capacitance and the long-period variations which have a considerably greater amplitude are screened. This method makes it possible to conduct round-the-clock recordings of short-period variations of earth currents with a scan speed of 30-60 mm/minute without essentially increasing the use of film.

The quantitative evaluation of the recordings is made more difficult because the sensitivity of the apparatus is a function of the frequency forcing the oscillations; in other words, the sensitivity of the apparatus is determined by the frequency characteristic of the capacitance-galvanometer system.

Simultaneous world-wide observations of short-period oscillations of earth currents by this method are specified under the IGY program. The production of comparable high-speed recordings is determined mainly by the degree of identification of the frequency characteristic of the apparatus. In the process of comparison, both the values of the amplitude of the separate geoelectric disturbances as well as the time of their entry are compared. Therefore, in addition to the amplitude of the frequency characteristic which reflects the relationship of the sensitivity to the frequency of the oscillations being studied, it is often necessary to know the frequency relationship values of the phase displacement between the oscillations at recording and at entry into the apparatus. The methods of determining the amplitudes and the phase characteristics of the system are discussed. (Izvestiya Akademii Nauk Turkmenskoy SSR, No 1, Jan 58, pp 3-10)

Adolf Schmidt Observatory at Niemegk

An illustrated, popular-type article titled "The Adolf Schmidt Observatory for Geomagnetism in the International Geophysical Year," by H. Schmidt and H. Wiese, gives the following information:

The observatory, which was founded in 1930, forms, together with the institute branch at Potsdam, the Geomagnetic Institute of the German Academy of Sciences, which is under the direction of Prof Dr G. Fanselau.

Along with continuous comparisons with Danish, Austrian, and West German observatories, joint measurements will be made in Niemegk with geomagnetologists of Czechoslovakia, Poland, Rumania, the USSR, and Hungary, within the program of the IGY.

Ribbon-type magnetic balances manufactured by VEB Geraete- und Reglerwerke, Teltow, are adjusted and tested at the Niemegk observatory. For the purpose of testing, adjusting, and calibrating various instruments and for nuclear resonance research, an instrument was built at Niemegk for the production and retention of magnetic fields of any strength, equal in magnitude to that of the Earth. It comprises three enclosures, one of which is completely nonmagnetic, and contains a system of three Helmholtz coils several meters in diameter, which produce a field which can be determined in three components. The currents producing the field can be controlled by three Foerster sondes in the second enclosure, which impart the control signals to the electronic control devices in the third enclosure. With this installation, the field at the North Pole, or in Australia, for example, can be produced in a very short time and maintained at a constant value, so that variations of the Earth's magnetism will not interfere with the measurements.

The Niemegk observatory and the universities of Leipzig and Berlin are working jointly on the development of the modern method of measuring geomagnetism by proton resonance. These efforts involve an audio-frequency method of proving the Larmor frequency with which atomic nuclei (protons) precess like small gyroscopes within a magnetic field. If a magnetic field of about 10,000 gauss is applied, the precession takes place in the high-frequency range, and in the low-frequency range, if a weak magnetic field (such as that of the Earth with 0.5 gauss) is applied. If a continuous resonance of these protons in the Earth's field could be observed, then the "whistling" of the Earth's magnetic field could be "heard," since the resonant frequency of the protons, for Niemegk conditions, is about 2,000 cps, a readily audible whistling tone. If magnetic variations occur, the pitch of the whistling tone should change.

Since observatories are too far apart to make the compilation of a map showing the continuous values for the Earth's magnetic field possible, additional field intensity measurements are being made at the so-called points of the first order, such as are established in geodetic surveys. This "surveying" of East Germany by the Geomagnetic Institute has been going on for years. VEB Geophysik Leipzig is assisting in the measurements, particularly in the magnetic surveys of various underground deposits.

On 5 November 1957, an eruption on the Sun caused a small pip in the curve being recorded by a Niemegk geomagnetograph; about 30 hours later a magnetic storm was recorded on a "coarse" geomagnetograph having a chart width corresponding to a change of declination of 1.1° or a change of field of 360 γ (illustrated).

In addition to these larger variations there is great interest also in the rapid variations which are scarcely visible on normal registering devices, and which are often quite regular. These "time gradients" are recorded at the Niemegk observatory by means of large air-core coils connected to galvanometers.

The local differences of the variations of geomagnetism are used as a basis for drawing conclusions in regard to the altitude, current-density distribution, and other characteristics of the current systems produced in the upper atmosphere by corpuscles. The apparatus used for this purpose, the "local gradient" recorder, is one of the very few of its type in the world. At Niemegk this installation consists of four magnetometer stations which are located at the corners of a square, the length of the sides of which are about 7 kilometers. These stations are connected with a centrally located main station by means of underground cable. The magnetometers produce, photoelectrically, currents which are proportional to the magnetic field and which are fed to the main station where they are compared. A whole series of components of the local gradients can be recorded through suitable switching arrangements.

Other important research work at Niemegk during the IGY is the measuring of secondary earth currents by means of two electrodes buried in the ground at a definite distance from each other. Since the range of depth of earth currents is greater, the greater apart the electrodes are spaced, Niemegk is recording on lines spaced 100 meters, 1,000 meters, and 100 kilometers apart. The latter lines have been made available by the German Post Office (long-distance cable).

The induced currents which, for variations up to 2 hours, have their primary flow at a depth of about 50-80 kilometers, can also be detected by their magnetic effects. In recent years it was found that these currents follow preferred paths, which can be traced for all of Europe. These paths are conditioned by relatively high anomalies of the electrical conductivity in the subsoil. To study these anomalies, the Niemegk Observatory has erected special field recording stations; the course of these zones of conductivity will be surveyed by Niemegk for all of Eastern Europe. In the field recordings the anomalies are revealed by the fact that, on the one side of the anomaly, the variations of the vertical intensity of the geomagnetic field are positive, and negeative on the other side. The horizontal component increases directly above the "flow."

Auxiliary stations have been established for the purpose of recording these field measurements and forwarding the data to Niemegk during the entire IGY. These stations are in Wismar (Warnkenhagen), in the vicinity of the mouth of the Oder (Ueckermuende), and near Zittau (Herrnhut).

Photographs include views of a magnetic theodolite, a vibration-period measuring device for standard magnets, a thecdolite for determining declination and horizontal intensity, vibration-period measurement with quartz-clock synchronization, an earth inductor for measuring inclination, adjusting of a magnetic balance, coil systems for the production of arbitrary magnetic fields, and a view of the enclosures for measuring local gradients. (Wissenschaft und Fortschritt, No 2, Feb 58, pp 65-68)

New Discoveries by Soviet Oceanographic Expeditions

In 1957, Soviet scientists, working in accordance with the IGY program, made important discoveries in various regions of the world's oceans. These discoveries are recounted briefly in a Soviet educational geographic journal which bases its information on Vodnyy Transport of 14 January 1958 and other sources.

"In the central part of the north Arctic Ocean, while studying the submerged mountain range imeni Lomonosov, Soviet explorers discovered an active volcano. The scientists express the opinion that this acitve volcanic seat is not unique in these high latitudes.

"At the same time the Soviet high-latitude expedition on the diesel-electric ship Lena investigated the central part of Nansen's Rise, a submerged range connecting northeastern Greenland with northwestern Spitzbergen, and considered the natural boundary between the Greenland Sea and the Arctic basin. It was thought that the depths over the Nansen's Rise did not exceed 1,500-2,000 meters. Soviet scientists established that the depths over the rise were from 2,800 to 3,500 meters. From this it may be assumed that the central part of Nansen's Rise is interlaced with deep channels.

"The Soviet Hydrographic Expedition aboard the four-master boat Sedov conducted an investigation in the tropic and subtropic parts of the Atlantic Ocean. Academician V. V. Shuleykin was the first to succeed in registering the so-called telluric currents, which are caused by the corpuscular radiation of the Sun, in the depths of the open sea. In the region of the Cape Verde Islands the expedition discovered and investigated banks which were not shown on their maps.

"Soviet scientists working under the program of the International Geophysical Year aboard their own expeditionary ship, the Vityaz, in the Pacific Ocean, also made new and outstanding scientific discoveries.

"Near the equator, using a perfected fathometer they discovered an enormous submarine mountain, which, as to size, would not yield to our El'brus. The mountain was called "Vityaz Peak" in honor of the ship.

"Soviet scientists were the first in the history of science to make a detailed study of the Tonga depression, a gigantic fissure in the bottom of the ocean over 1,000 kilometers in extent (the width of this depression in all is only several kilometers). Trawling of the depression was done, pictures of the bottom were taken, various information concerning life on the bottom of the depression was collected, etc. The Vityaz's powerful fathometer revealed that the Tonga depression was considerably deeper than previously supposed. A depth of 10,772 meters was recorded. This is the deepest spot in the southern hemisphere." (Geografiya v Shkole, No 2, Mar-Apr 58, pp 66-67)

VI. LATITUDE AND LONGITUDE

New Astronomical Instruments To Be Installed

New instruments will be installed this year in the Astronomical Observatory in Belgarde for the precise determiniation of the coordinates of celestial bodies. Among the few observatories in the world which have these instruments are observatories in Washington, in Greenwich, and at the Cape of Good Hope, and the Pulkovo Observatory in the USSR.

In a conversation with a representative of Jugopres, Milorad Protic, director of the observatory, said that the establishment of this service will represent a significant contribution to astronomical science in general, and particularly to the undertakings of the International Geophysical Year. International activity is in progress, for example, on the development of a basic catalogue of lesser-magnitude stars (stars of lesser brilliance). Precise determination of their positions, or coordinates, can be made only by means of large transit and meridian refractor telescopes, as well as zenith telescopes.

According to the director of the observatory. the state has been very sympathetic toward the establishment of a service for basic astronomy. (Sarajevo, Oslobodjenje, 12 Feb 58)

VII. ARCTIC AND ANTARCTIC

Operation of Severnyy Polyus-6

At the end of January, the drift station Severnyy Polyus-6 was drifting north of Novosibirskiye Ostrova in the vicinity of the 79th parallel.

Ionospheric observations are continuing to be made every 15 minutes on a round-the-clock basis, according to the IGY program. On 20 January, the instruments showed a decrease in density of ionization in the ionized layers of the atmosphere, which indicated that a magnetic storm was developing. The magnetologist checked his instruments and discovered an increased disturbance of the magnetic field.

Processes in the ionosphere are closely connected with the Earth's magnetic field, and also with the phenomenon of aurorae. On clear days, the automatic camera at the station takes three pictures of the whole sky every minute, reflecting the rapid changes in the forms of aurorae on the photographic film.

According to the IGY program, four radiosondes are released every day. Three staff members attend each radiosonde launching: one of them listens to radio signals transmitting information on temperature, pressure, and humidity of the air; the second person watches the ascent of the radiosonde with a optical theodolite; and the third person makes observations with the help of a radiotheodolite, determining the location of the radiosonde at any moment of its flight and thereby learning the direction and speed of wind at any altitude. The highest altitude reached on one day was 26 kilometers, and the lowest was 23 kilometers. These are not record altitudes, but they are considered quite satisfactory.

Meteorological observations at the station are conducted alternately by two scientists. Every 3 hours the meteorologist on duty checks the instrument readings at the meteorological platform. The height of the clouds is determined with the help of a searchlight. A coded weather report is given to the radio station.

Depth soundings are taken several times a day. The hydrologists conduct observations every hour for 15-day periods. Automatic devices for recording sea currents are lowered by a thin cable into one of two holes cut in the ice; the second hole is used to determine the depth of the sea and the speed of drift. (Moscow, Vechernyaya Moskva, 23 Jan 58)

Expedition of Arctic Institute

The expedition of the Arctic Institute on Ostrov Kheysa (Franz Josef Land) in the Arctic will remain in this location until the end of the IGY. The high-latitude observatory in this place will conduct a full cycle of geophysical observations.

During the period of its stay in the Arctic, the expedition will organize the launching of 25 meteorological rockets to investigate the upper atmosphere, as well as other important and extensive tests connected with the further development of the Northern Sea Route. The expedition is headed by K. Fedchenko, Candidate of Physicomathematical Sciences. The staff includes specialists in meteorology, actinometry, cosmic rays, magnetism, and other branches of science. The polar scientists are equipped with the latest scientific instruments. (Morskoy Flot, No 2, Feb 58 p 31)

Aerial Expedition in Arctic

On 22 March, an aerial expedition of the Arctic Institute left for the Arctic to install a number of DARMS (drifting radiometeorological stations) and radio beacons on the ice.

Last year's experiments in the use of automatic installations on drifting ice of the Central Polar Basin proved successful. With the help of these stations, daily information was received on temperature, air pressure, and wind speed and direction, which greatly improved weather reports for regions of the North. The use of radio beacons made it possible for the first time to obtain data on ice drift simultaneously at many points. This enabled scientists to discover a number of peculiar features of ice processes which had not been studied before.

Two detachments of the aerial expedition will be in charge of installing the drifting stations at various points of the western and eastern sectors of the Northen Sea Route, as well as in the drift area of Severnyy Polyus-6. Later, at the end of May, an additional number of DARMS and radio beacons will be installed with the help of airplanes. The 1958 expedition includes hydrologists and ice specialists. (Moscow, Vodnyy Transport, 25 Mar 58)

Ultrasonics Used in Studying Elastic Properties of Ice

The problem concerning the use of an ultrasonic impulse method for determining the elastic properties of polycrystalline ice is presented by V. V. Bolorodskiy, Arctic Scientific Research Institute, Leningrad. Using this method, Young's modulus and the shear of polycrystalline ice is determined in relation to its thermal and structural properties according to the velocity of propagation of longitudinal and transverse waves. Experiments for determining the ultrasonic velocities were made in fresh-water ice and in the region of the drift station Severnyy Polyus-4, using a specially developed instrument.

The working principle of the instrument and the method of measuring is as follows: A master oscillator through a fixed time internal triggers a sweep generator and a high-frequency pulse generator. The pulse generator excites a piezoelectric transducer which radiates the acoustic impulse in the medium being studied. After passing through a determined distance in the medium, the acoustic impulse excites the receiving piezoelectric transducer. The electric oscillations from the receiving piezoelectric transducer are transmitted to an electronic oscilloscope.

For measuring the time interval between the sending of the acoustic impulse into the medium and its reception after passing through a certain path, the sweep time on the indicator screen is calibrated by using an electronic calibrator.

Control of the accuracy of the instrument readings according to velocity is done by using a special standard acoustic line. After having measured the time of propagation in the medium being studied and the length of the path traveled (i.e., the size of the medium under study), it is possible to calculate the velocity of propagation of the elastic wave. The excitation of longitudinal waves in the ice was produced by using barium titanate plates, and the transverse waves are produced by Y-cut quartz vibrators which were frozen to the ice. All the piezoelectric transducers had a resonance frequency of 500 kilocycles. The use of Y-cut and Curie-cut plates made it possible to simultaneously determine the velocity of both the longitudinal and the transverse waves. Thus the values of all the elastic constants of the ice cover could be obtained very accurately in relation to temperature, salinity, etc.

The impulse ultransonic method of studying the physical properties of ice has important advantages over other methods, in relation both to simplicity and speed of measurements and to accuracy.

The results of measurements made on ice in fresh-water basins made it possible to practically establish the linear relationship of the velocity of elastic waves to temperature.

The elastic coefficients of ice monocrystals and the dynamics of their measurements in relation to different conditions (temperature, stresses, etc.) can be most easily studied by the impulse ultrasonic method. (Akusticheskiy Zhurnal, Vol 4, No 1, Jan-Feb 58, pp 19-23)

Launching of Meteorological Rockets in Antarctic

The Antarctic Marine Expedition includes an aerometeorological detachment, headed by G. Golyshev, which has the task of investigating the upper atmosphere with the help of special meteorological rockets. During the 1957-1958 navigation period in the Antarctic, 30 rockets are to be launched. The Marine expedition is headed by Prof V. Kort. (Morskoy Flot, No 2, Feb 58, p 31)

Slava-15 Visits Uninhabited Island

Slava-15 is an scientific research ship, which is included in the Slava whaling flotilla operating in the Antarctic. On 20 January, scientists aboard the ship were conducting research in the area of the South Sandwich Islands. They went ashore on the uninhabited Montague Island, where they found a large number of seals, thousands of penguins, sea gulls, cormorants, and stormy petrels. The scientists collected a large number of birds' eggs and shot many birds for the purpose of mounting stuffed specimens. They also collected geological samples on the island, and left a sign on the island to indicate the visit of the Slava seamen. The mounted specimens will be distributed among museums of the USSR.

Hydrological observations, and hydrobiological and zoological research were conducted in the area of the South Sandwich Islands. All the ships of the whaling flotilla conduct meteorological observations, which are regularly transmitted by radio to Moscow. (Moscow, Vechernyaya Moskva, 22 Jan 58)

New Staff at Station Vostok

The scientific staff of the station Vostok, near the south geomagnetic pole, was replaced in January by a new group of scientists who were flown to the station. The new staff, consisting mostly of young people, is headed by V. Sidorov, an experienced polar scientist. Despite unfavorable conditions, i.e., low atmospheric pressure, lack of oxygen, and minus 40-degree C frost, the station was taken over from the second staff in a short period of time.

Scientific work under the IGY program is already in progress at the station. Observations are conducted in the fields of terrestrial magnetism, meteorology, and actinometry. Radiosondes are released daily into the upper atmosphere. An ionospheric camera and a camera for photographing aurorae will soon be installed.

The station staff is facing the antarctic winter and polar night; during this period temperatures are expected to drop as low as minus 85 degrees C. Various preparations are being made to protect the staff members from the cold. The magnetic and aerological pavilions will be connected with the living quarters by a 50-meter tunnel built in the snow. (Leningradskaya Pravda, 31 Jan 58)

New Soviet Station Sovetskaya

On 16 February 1958, the Soviet Antarctic Expedition raised the USSR flag at a point 78-24 S and 87-35 E, at an altitude of 3,720 meters above sea level. During a 6-day period, 27 men worked in minus 59-degree C temperature, building the new station Sovetskaya. The station includes an electric power unit, radio and meteorological stations, living quarters, kitchen, and storage hut. An airfield, a meteorological platform, and an aerological pavilion were built at the same time, and steel radio masts were erected. The station Sovetskaya, in the region of the pole of relative inaccessibility, has begun its regular scientific work under the IGY program.

At present, during the "warm" season of the year, the temperature fluctuates between minus 32 and 59 degrees C. According to theoretical estimates of foreign scientists, one can expect temperatures of minus 80° C or even lower during the antarctic winter in this region.

Living conditions for the wintering party are as favorable as possible. The station building is warm and comfortable. The station has sufficient reading material, a movie projector with 20 movie films, and a magnetophone. Radio broadcasts from Moscow are heard regularly. The staff has become adjusted to the high-mountain conditions and low temperatures and is busy making preparations for the approaching cold winter months. -- V. Babarykin, chief of station Sovetskaya (Ogonek, No 12, 16 Mar 58, p 20)

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