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UNCLASSIFIED- 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

### Main Problems in Cosmonautics Discussed by Soviet Scientist

Prof G. V. Petrovich has published an article entitled "Basic Problems in Cosmonautics: in the official organ of the Academy of Sciences USSR. The following is the full text of that article.

Today, when the first stages in the development of rocket problems have already been passed, when both intracontinental and intercontinental rockets, as well as artificial Earth satellites, have been built, the question arises as to what will the subsequent stages in the growth of rocket engineering be like and what paths will further development of cosmonautics follow?

The achievement of three critical cosmic velocities are fundamental landmarks in the development of cosmonautics. The first of these is a circular velocity (around 8 kilometers per second), which is the minimum required for the creation of an artificial Earth satellite; the second cosmic velocity is parabolic (around 11 kilometers per second), which is the minimum required for escaping the Earth and revolving as a satellite of the sun, as an independent planet, and, consequently, also for obtaining the possibility of flight to other celestial bodies of our solar system; the third cosmic velocity is hyperbolic (around 16.7 kilometers per second), which is the minimum necessary to escape our solar system forever and to head for the stars.

By achieving velocities within the range of approximately 8-11 kilometers per second, a cosmic ship will remain an artificial Earth satellite and will describe an even greater elliptical orbit, the greater its velocity becomes. The use of this energy reserve will enable a space ship to accomplish movement around the Earth in an orbit, close to circular, located at varying distances from the Earth.

Achieving a velocity in the range of approximately 11.5-16.3 kilometers per second, a space ship can make flights to different planets of our solar system; the greater the velocity of the space ship, the more distant planets it will be able to reach. Both the achievement of the first cosmic velocity and of the other two critical cosmic velocities will be epochal in the history of the development of mankind. It is natural that the significance of each of these events will be all the greater, the bigger the mass of the payload to which the critical speed is imparted. The imparting of critical velocities to a payload of only several kilograms has an immediate symbolic significance and speaks not only of an achievement of science and engineering, but also of the limited possibilities for conducting the experiment.

Thus, the path of the future development of cosmonautics is the struggle for the mastery of greater possible velocities for the greatest possible payload. Progress in this struggle will be determined by the successes of rocket science and engineering, that is, it is possible only on the basis of further improvement and development of rockets, rocket engines, and flight control systems.

To us, it seems timely to organize the recording by an official international organ of the achievements in the development of rocket engineering in the different countries, just as this is being done in aviation. The recorded indexes should be the speed of flight, taking into account the altitude and the magnitude of the payload to which this speed is imparted for various classes of rockets (one-, two-, three-stage, etc.) and artificial Earth satellites.

Peaceful competition of different countries in the mastery of cosmic space would greatly stimulate the development of cosmonautics.

The main task is the further development of means of reaching cosmic space, that is, to develop the best rocket ships.

The use of rational layouts of rockets, scientifically substantiated methods of construction, the most durable and light construction materials, and the creation of the most improved control systems, distinguished for exceedingly high precision and moderate weight, will make it possible to achieve successful results. The development of methods of computing the most advantageous trajectories of the rocket in cosmic space and the rendering of these calculations for concrete given conditions is extremely important.

The volume of computation work necessary in developing a space ship, and especially for selecting rational flight trajectories is so vast that only the use of high-speed electronic computers makes this task practically solvable.

The determining factor in accomplishing flights in cosmic space is the level of development of rocket engines. The velocity achieved by a rocket, in the first instance, is determined by the power characteristics of its engine. In contemporary rocket engines, chemical energy is used as a source of power. Further improvement of these engines will make it possible ultimately to use fully the potentialities of chemical sources of energy, with the exit velocity of the combustion products close to 4,000 meters per second. Multistage rockets with such engines will be able to attain all three cosmic velocities, even when starting from the Earth, without additional refueling at artificial satellites. The use of artificial Earth satellites as an intermediate landing or refueling station makes all corners of our solar system accessible to man, thus guaranteeing the possibility of flight of space ships with great payloads.

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If we take into account the possibility of creating artificial Earth satellites as intermediate stations equipped with fuel reserves and other materials' near various planets, for example, Venus and Mars, then it becomes evident that rockets with engines using chemical sources of energy have already solved the problem of interplanetary communications.

However, the great distance of the planets, especially the outer ones, from the Earth means that a very long time will be required to reach them from the Earth, if the flights are to be made at velocities close to minimal. For example, flight to the moon would take days, but a flight to Mercury, Venus, and Mars would be counted in months; Saturn, in years; and to the more distant planets, in decades.

Flight to these celestial bodies with the third critical cosmic velocity (16.7 kilometers per second), ultimately, would shorten the length of flight but still, travel would take long enough -- a flight to Mars would take 2.3 months; to Jupiter, 1.1 year; to Saturn, 2.5 years; to Uranus, 6.8 years; to Neptune, around 13 years; and to Pluto, 19.2 years.

Moreover, these flights could be made only during those rare moments when the planets would be in a position most advantageous for such flights. If we take into account that the condition of the most advantageous return to Earth also has to be considered, then the timetable allowing flights to the planets and the duration of the flights will prove to be little suitable for practical purposes.

Therefore, after the first successful flights to the planets, the need will inevitably arise for interplanetary flights along trajectories which are disadvantageous from the energy viewpoint, but ensure a more rapid and frequent communication with planets or their satellites. As a result, there will be a critical need for developing rocket engines which, for interplanetary flights, use sources of energy more efficient than chemical ones. By the time these engines are needed, they will be developed. It is still too early to judge whether these engines will be of an atomic, ion, or other type. Possibly these engines will make use of solar energy under conditions of flight to the planets which are nearer to the Sun than the Earth. On moving away from the Sun for a distance of the Earth's orbit, the efficiency of a solar rocket engine will obviously be insufficient, even with a high degree of efficiency of the transformers of solar energy into the reactive force of the ejected mass. Rocket engines using atomic energy are highly promising in principle. However, the use of such engines will be justified only in the case where they ensure higher specific thrusts than chemical rocket engines, and the specific weight of the operating body must not be so small as to reduce the efficiency of the engine. This makes it imperative to create atomic engines with a temperature of the operating body higher than in chemical rocket engines, that is, higher than 3,000-4,000°, which entails considerable, although surmountable difficulty.

Radiations of the reactor of an atomic engine make it difficult to use it for passenger rockets, since the weight of the heavy protective shield substantially depreciates the gain in specific thrust. For the same reason, it is difficult to use atomic engines for the first stages of the rocket which fall to Earth after the rocket is launched.

In such a case, the flight should be made in such a way so as to ensure the falling of the first stages into an agreed on zone, if such is created (for example in the ocean), or chemical engines should be used for these stages.

There is no doubt that in time, ways will be found for using atomic energy, ways which are free from the burdensome shortcomings of the nuclear processes known and mastered by us.

Definite hopes are associated with the idea of using ion flows in rocket engines, expressed for the first time by K. E. Tsiolkovskiy (cf. Vestnik Vozdukhoplavaniya, St. Petersburg, 1912, No 9, p 8.). However, such engines can operate only in vacuum and can develop only small thrusts at large weights. Moreover, there are difficulties involved in the use of an atomic reactor or solar radiation as a source of energy.

Much effort will be required for developing a scheme and creating a much improved engine capable of replacing the chemical rocket engine.

In the immediate future, all feasible problems of cosmonautics will be solved on the basis of chemical rocket engines.

It may be assumed that under condition of refueling of a rocket ship in flight, after it reaches the first cosmic velocity and starts from its orbit, future three-stage chemical rockets with a starting weight of several hundred tons will be able to develop a flight velocity of up to 27 kilometers per second, with a payload measured in tons. Considering the possibility of organizing a refueling station near the Earth at a higher orbit than the one which corresponds to the first cosmic velocity, the speed of the rocket can be increased by another three kilometers per second. Finally, the organization of long-distance flight of acceptable duration can be made easier by establishing refueling stations at the place of the destinations (in the form of artificial satellites of planets).

Our concept of the nearest stages in the development of cosmonautics are as follows: The further improvement of rockets, their engines and control systems, will serve as the basis of creating artificial Earth satellites of larger weight and size and carrying a wider range of scientific equipment. Let us recall that Sputnik I weighed 83.6 kilograms; the weight of the scientific equipment, sources of power and the experimental animal carried by Sputnik II was 508.3 kilograms; and the weight of Sputnik III was 1,327 kilograms. General progress prompts us to suppose the tendency toward further increasing the weight of satellites.

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The lifetime of an artificial Earth satellite will be all the longer the higher its orbit is above the limits of the atmosphere, the larger its weight, and the more compact its form, since the lifetime of a satellite is reduced only by the air drag. Satellites whose orbits are located above 1,000 kilometers from the Earth's surface can be considered eternal. It is expedient not to make the first satellites eternal, because observations of their motion through the upper layers of the atmosphere are needed for studying the structure of the atmosphere and the phenomena occurring in it. Sputnik I existed for 92 days, and during this time made about 1,400 revolution around the Earth, covering a total distance of close to 60 million kilometers. Its initial values were as follows: time of revolution, one hour, 36.17 minutes; perigee, 228 kilometers; apogee, 947 kilometers. Sputnik II lasted about 160 days and made 2,370 revolutions around the Earth, covering more than 100 million kilometers. Its initial values consisted of a period of revolution of one hour, 43.75 minutes, a perigee of 225 kilometers, and an apogee of 1,671 kilometers. Sputnik III has a revolution period of one hour, 45.95 minutes. With an apogee of 1,880 kilometers, its lifetime will be longer than that of the first two Sputniks.

In the near future, the perigee of the trajectory of artificial satellites will be located at an altitude of more than 1,000 kilometers above the Earth's surface as a result of which, the final stage of the carrier rocket and the satellite will not return to Earth and may be used for the construction of stations outside the Earth.

As a result of the further development of rocket science and engineering, oriented satellites will appear which, as distinguished from the first unoriented satellites, will not revolve arbitrarily around their own axes during orbital flight. Autonomous solar or long-lasting atomic sources of energy will be used widely on satellites. The developing of these means of energy supply of satellites requires immediate attention.

The effect of cosmic flight conditions on the vital activities of experimental animals will be studied further. Flights of rockets with dogs and scientific equipment to altitudes of 100-200 kilometers and much higher have been made systematically in the USSR for a number of years. Two dogs were usually placed on board of each rocket, while the weight of scientific instruments ranged from several hundred kilograms to several tons. The dogs were placed in hermetically sealed, instrumented cabins, and then they were brought back to the Earth by parachute. Catapulting from various altitudes during the descent of the rockets in the lowering of dogs placed in hermetically sealed suits by parachutes was also practiced.

The flight of Layka on Sputnik II was part of an integrated program for studying the effect of prolonged flights in rockets on the vital activity of experimental animals.

Together with these investigations, systematic work must be conducted for studying and ensuring safe rocket flights, not only for animals, but also for man.

The creation of passenger-carrying rockets and manned satellites is a matter of the next few years. To accomplish this, it is necessary not only to solve the problem of creating sufficiently powerful and efficient rockets, capable of imparting high speed to heavy payloads; it is also necessary to solve the specific problems which make flights on rockets safe for man. The degree of reliability of operation of the rocket equipment must be raised substantially.

On long-range rockets carrying a big payload, the thrust of the engines is measured in hundreds of tons and the maximum useful capacity of the engine installations in flight reaches tens of millions of horsepower, surpassing the capacity of the most powerful hydroelectric power stations in the world. If account is taken of the fact that in these superpowerful engines, subjected to serious vibration and static loads, unusually high temperatures and considerable gas pressures are combined with exceptional lightness of the installation, it will become clear what tremendous and painstaking work has to be accomplished to achieve sufficiently safe, faultless operation of these engines. The control systems in the entire rocket also have to be thoroughly worked out; without them reliable operation cannot be achieved. Preliminary theoretical and experimental, laboratory and test-stand work carried out with scrupulous care and thoroughness on all elements of a rocket, as well as on the rocket as a whole, are essential for the successful accomplishment of the tasks of safe rocket flight. Subsequent flight tests, conducted in accordance with an extensive program should precede flights by man.

Nonfulfillment of these works, as a rule, leads to failures in attempts to launch a big and complex rocket, regardless of the payload it carries. Calculations based on a single success are not worthy of attention and if a man is present on board the rocket, are not permissible.

All units and instruments guaranteeing the functioning of the human organism in flight must work absolutely faultlessly. Particular attention should be devoted to devising a system of safe landing of man after his ascent on a rocket. The return of man to Earth should be made by rational use of atmospheric drag. Evidently, a gliding descent will be the chief means of landing cosmonauts, not only on Earth, but also on other planets possessing a sufficiently dense atmosphere.

Gliders of minimum weight for landing the crew on the surface of a planet will be a necessary fixture on many space ships and stations outside the Earth.

The solution of the problem of safe flight on a rocket and the landing of man on Earth will make it possible to enter into the establishment of manned satellites equipped with air-conditioning installations, supplies of food and oxygen, and replacement crews. Regular communication will be maintained between the crew of satellites and the Earth for the transfer of equipment, materials, and crew replacements. Flights from the Earth to satellites should be effected by rockets and the landing on Earth by gliding in the atmosphere, using almost no fuel at all.

Such an oriented manned Earth satellite with an independent energy reserve and a supply of fuel components could serve as an intermediate station for passenger rockets intended for flights to the Moon and other planets.

This is how flying laboratories, observatories, and interplanetary stations will be established.

Let us point out that the establishing of fuel supplies outside the Earth is possible by launching cargo rocket-tankers in trajectories around the Earth. Possessing exact knowledge of the elements of the trajectory of the cargo or freighter rockets, passenger rockets can find them and approach them to refuel. In such a case, the creation of a station outside the Earth as an oriented manned refueling base will not be necessary.

Simultaneously with the creation of heavy Earth satellites, automatically guided rockets will be built for reaching the Moon and flying around it. These rockets, supplied with scientific equipment, will make their extremely interesting flights before manned Earth satellites are developed.

Recent investigations in the Soviet Union have significantly clarified the problem of dynamics of rocket flight to the Moon (cf. V. A. Yegorov, "On Certain Problems of Dynamics of Flight to the Moon", Uspekhi Fizicheskikh Nauk, 1957, Vol 63, No 1-a, pp 73-117). Various forms of trajectories for reaching the Moon or flying around it have been studied and the necessary minimum speeds of flight have been determined. Scientists have analyzed possibilities of flying around the moon and returning to the Earth with a sloping re-entry into the atmosphere, periodic flights around the Moon and the Earth, the possibilities of using perturbations from the Moon for accelerating the rocket without the expenditure of fuel during a flight from the Earth to more distant celestial bodies and the capture of a rocket by the Moon and converting it into a permanent satellite of the Moon. The exact initial data required for obtaining a trajectory of lunar flight have also been determined.

The first flight by a rocket to the Moon will open up another glorious page in the history of mankind, since it will signify the mastery of the second critical cosmic velocity.

Just as the launching of the satellites is conducted in accordance with a broad program, so we should similarly expect a series of launchings of "lunar" rockets. They will be equipped with diverse scientific instruments and will solve a number of concrete problems of considerable importance.

Besides the very fact of a rocket reaching the Moon's surface, of great interest will be the study of cosmic rays beyond the magnetic field of the Earth, the meteorite hazard, and a number of other properties of outer space at various distances from the Earth, reaching up to 400,000 kilometers.

Of considerable significance will be the flights around the Moon and the return of the rocket near the Earth, which will make it possible to obtain images of the hemisphere of the Moon which are not visible from the Earth and to make a number of other highly valuable investigations, for example, the influence of such a long flight, far removed from the Earth, on the vital activities of experimental animals.

Flights of "lunar" rockets will testify to the maturity of rocket engineering, its readiness for flights to the nearest planets, Venus and Mars. Indeed, the minimum required velocity for rocket flight from Earth to these planets is only several hundred meters per second greater than that velocity required for flight to the Moon; whereas, for a flight to the Moon, this speed is approximately 11.2 kilometers per second, the required velocity for a flight to Venus is 11.5 kilometers per second, and to Mars, it is 11.6 kilometers per second.

Naturally, flights to Venus and Mars have to be made along trajectories passing sufficiently near to these planets, possibly for flying around them and returning the rockets to the Earth and transmitting by radio information accumulated during the flight in the memory devices on board the rockets. For recovering the rockets, a somewhat higher velocity than indicated above would have to be imparted.

The first flights to planets, just as to the Moon, will be made by automatically guided unmanned cosmic rocket-explorer ships. Only after sufficient data has been accumulated on the properties of outer space, the effect of cosmic and short-wave radiations on living organism, the degree of permissibility of duration of prolonged weightlessness for the vital activity of an organism, and after reliable protection of man from the meteorite hazard and the harmful effect of the conditions of flight in outer space have been worked out will a crew appear on board an automatically guided cosmic rocket.

Evidently, mankind will twice observe landmarks of its remarkable task in penetrating outer space; the first time, when automatically guided rockets will attain considerable altitudes and eventually acquire velocities exceeding all the critical cosmic velocities; and, the second time, when man will appear on board automatically guided rockets which have achieve all these altitudes and velocities.

Such are the fundamental stages in the mastery of outer space, and these stages will have to be covered by us in the years to come.

The means of long-distance radio communication of rocket ships with the Earth, with stations outside the Earth, and between themselves will also have to be developed for successful accomplishment of the tasks of cosmonautics. Radio communication has to insure the guidance of rockets, telemetering of information from the rockets, including television, and also to serve as a control of the trajectory of the rocket flight.

And the development of apparatus for scientific investigations on rockets and artificial Earth satellites should not lag behind. It is necessary to make full use of the richest possibilities of investigations of the Earth and cosmic space which are being opened by the rapid development of rocket engineering. (Vestnik Akademii Nauk SSSR, No 6, Jun 58, pp 28-34)

## II. UPPER ATMOSPHERE

### First Complete Soviet Report on Aswan Expedition for Observing Zodiacal Light

V. G. Fesenkov, a foremost Soviet astronomer and leader of the Academy of Sciences USSR expedition to Aswan, Egypt for observations of Zodiacal light and optical properties of the atmosphere sums up his report (a complete translation of which follows) on the expedition as follows:

"Our expedition to Aswan, Egypt, included V. G. Fesenkov, Ye. V. Pyaskovskaya-Fesenkova, N. B. Divari, V. M. Kazachevskiy, and P. N. Boyko. Two Egyptian scientists, Dr Adly Asaad and Dr Emara Saeda, also took part in the work of the expedition. A vast program of observations was conducted, including photometric, colorimetric, and photographic measurements of zodiacal light with polaroid screens and interference filters. During the daytime, systematic measurements of the distribution of brightness and polarization of the sky were made. Solar halo phenomena were also studied. The coefficient of transparency was determined regularly by direct and indirect methods developed by Ye. V. Pyaskovskaya-Fesenkova. Altogether, nearly 30,000 separate determinations of brightness were made.

"The atmospheric conditions in Egypt near Aswan are remarkable for their great optical stability. It was found that the transparency as well as the degree of polarization are greater after mid-day, which is quite contrary to the usual conditions.

"The theoretical discussion of observational data on zodiacal light is rather complicated, as it was found necessary to take into account the so-called zodiacal twilight. It can be expected that new data, useful for a better understanding of the true nature of this phenomenon, will be derived after the completion of the above discussion.

"The work of the expedition owes much of its success to the Egyptian astronomers, especially the director of the Helwan Observatory, Professor Samaha, and to the aid received from Egyptian authorities in Cairo and Aswan."

A full translation of the complete text of Fesenkov's report ("Expedition of the Academy of Sciences USSR to Aswan, Egypt for Observations of Zodiacal Light and Optical Properties of the Atmosphere"), as it appeared in the Astronomical Journal of the Academy of Sciences USSR, follows:

Investigations of intermediate matter in our galaxy and in the solar system are of great scientific interest. In particular, the nature and the structure of interplanetary matter has a direct relationship to the peculiarities of corpuscular streams which are ejected by the Sun and reach the Earth, and also to the structure of the highest layers of the atmosphere. Actually, it is impossible to separate the upper atmospheric layers themselves from the nearest interplanetary matter because of the fact that our atmosphere passes gradually into interplanetary space without any kind of disruption of continuity. By studying interplanetary matter, it is possible also to arrive at a definite conclusion concerning the character of the highest atmospheric layers which already are losing spherical symmetry.

The scattering properties of interplanetary space are manifested in the most evident form in the phenomena of so-called zodiacal light which spreads along the zodiacal constellations of the celestial sphere, chiefly along the great circle of the ecliptic. However, in the middle latitudes, the angle made by the ecliptic with the horizon is entirely different from a right angle and, therefore, the conditions of visibility of zodiacal light are not fully satisfactory. Consequently, as is known, zodiacal light was well-known in Europe only since 1680, when it was discovered by J. D. Cassini, founder of the Paris Observatory. On the other hand, in Egypt, this phenomena was well known since primitive times and was depicted by priests in the form of a triangle, straight or slightly inclined in relation to the horizontal line. Actually, only below a geographic latitude of 24°, and also further south, zodiacal light in certain periods of the year is observed completely perpendicular to the horizon, that is, under the best possible conditions at the slightest angular distance from the Sun, when it achieves greatest brilliancy. Moreover, extremely important is the circumstance that under the Tropic of Cancer, or further south, during the same night, both branches east and west of the zodiacal light may be observed, of course, at completely different angles of inclination to the horizon. Thus, for example, in Aswan in October-November the eastern zodiacal light is completely normal with the horizon until sunrise, but the western zodiacal light, visible at night after sunset, is very inclined. Simultaneous observations of both branches of zodiacal light under such completely different conditions of visibility have great importance. Both of these branches belong to one and the same phenomenon and, therefore, ought to be completely identical, even though they are represented by completely different results of various conditions of visibility. It should be noted that, in fact, a certain integral effect depending on the simultaneous superposition of many sources of illumination of the night sky is observed: the ionospheric component, depending on the illumination of the ionosphere being in an electric state; the integral brightness of the stars of our gallaxy; light dispersed in our troposphere illuminating all of these sources of light; and, together with them, the zodiacal light itself. If, in addition, there is additional brightness depending on the geometry of the highest atmospheric layers, then this effect also distorts the observed zodiacal light and can be distinguished from it. Moreover, the brightness of the zodiacal light observed to a considerable degree depends on the general condition of the troposphere and on its transparency.

On the basis of what has been said, it is clear that true outlines and distribution of brightness in zodiacal light cannot be attained without a knowledge of the coefficient of transparency and indicatrices of scattering in the Earth's atmosphere as a whole. The coefficient of transparency can be determined at night, but this is not very easily done and requires special instruments. Indicatrices of scattering, another important element in atmospheric optics, can be accomplished only under daylight conditions, when the brightness of the sky is determined only by the angular distance from the Sun and by the zenith distance from the point of the sky being observed. Therefore, observations of zodiacal light for the possibility of making a complete reduction of the observations also requires additional data related to the optical condition of the atmosphere which should be determined during the day with the aid of appropriate apparatus. For this, it is necessary to have two observing parties -- one for night, and the other for daytime observations and their best placement should be at a latitude of no more than 24°, that is at the latitude of Aswan.

It should also be noted that in southern Egypt, atmospheric conditions are nearly ideal; as a rule, clouds are absent (occasionally there are slight cirrus clouds), and dust storms rarely occur. Humidity is very low, and the brightness of the day sky is formed almost solely by scattering of light by molecules of air and fine dust. The absence of water vapors in the air over Aswan manifests itself also in a so-called phenomenon of a green ray which may be observed, as a rule, each day during sunrise or sunset and is distinguished by its very high intensity. In addition, in the absence of clouds in the atmosphere, southern Egypt is distinguished also by very high optical stability, which is very important for the theoretical discussion of data obtained by observers. On account of this, it is very desirable not to be limited only to minimally necessary observations for discussion of observed data in relation to zodiacal light but to formulate also a program of daytime observations related to the optical properties of the atmosphere based on a very broad plan.

This is even more desirable, considering the fact that to this time in Egypt, no observational works in the field of atmospheric optics were conducted and available specialists were limited only to purely theoretical discussions, unconfirmed by factual data. On the basis of the observations mentioned in the program according to atmospheric optics, problems having an independent interest were also included. According to the facts mentioned above, the program of work of the expedition of the Academy of Sciences USSR included the following:

1. The conduct of general photometry of zodiacal light with different light filters especially adapted for visual and photographic regions of the spectrum. This photometry should be sufficient for constructing a system of isophotes of zodiacal light taken separately for different moments of time in the course of several hours of its visibility, right up to the beginning of dawn, or immediately at the conclusion of twilight and to a sufficient sinking of the sun beyond the horizon. All photometric determinations should be expressed in absolute units, for example, in the number of stars of fifth magnitude per square degree.

2. Determination of color of zodiacal light under these conditions.

3. Conduct of general photometry of the entire night sky, also in absolute units. Appropriate observations can be conducted over very wide intervals according to azimuth and zenith distance and should be sufficient for making a system of isophotes of the entire celestial sphere for each hour of time.

4. Special attention is paid to so-called pseudozodiacal light, the zodiacal band and the Gegenschein.

5. Determination of polarization at various points of zodiacal light situated not only on its axis but also at various distances from the plane of the ecliptic. The degree of polarization and the vector orientation of polarization is found simultaneously.

6. Determination of the intensity of zodiacal light and adjacent areas of the sky in separate emission lines, especially in the 5577-Angstrom line, in comparison with adjacent areas of the continuous spectrum. Determination of the increase of emission in different parts of zodiacal light.

7. Photographing of zodiacal light with any kind of a camera noted for very high light-gathering power, for example, with a Sonar/Zeiss objective lens. The photographs obtained should be calibrated with the aid of an appropriate luminophore of known luminosity and should be suitable for photographic measurements.

On the other hand, the program of daytime observations with respect to optical properties of the Earth's atmosphere consisted of the following:

1. Systematic determinations of indicatrices of scattering by means of measurements of the brightness of the day sky at different points of the solar almucantar.

2. Determination of the transparency of the atmosphere for separate moments of time according to a rapid method developed by Ye. P. Pyaskovskaya-Fesenkova.

3. Determination of the transparency of the atmosphere according to Bouguer's method, and also according to the method of the solar aureole maximum.

4. Investigation of the change of atmospheric transparency during each given day.

5. Determination of the polarization of the day sky at various points and its change in specified points, for example, in the zenith during the day.

6. Finding numerical characteristics of optical stability of the atmosphere, for example, in the zenith during the day.

## Preparation for the Expedition

On the basis of what we said above, it is evident that observations of zodiacal light under the most favorable conditions should be conducted easiest of all in the region of Aswan, Egypt, and particularly during October-November, when the morning zodiacal light is nearly exactly situated perpendicular to the horizon, and the evening zodiacal light can also be seen very well, but rather considerably inclined. Parallel observations can be made in the USSR in the region of Alma-Ata.

The Committee for the International Geophysical Year under the chairmanship of Academician I. P. Bardin approved my proposal in this connection and petitioned the government to organize an expedition to Aswan, Egypt, under my leadership. The decision of the government was made on 26 May 1957. The staff of the expedition was composed, in addition to myself, of the following persons:

Ye. V. Pyaskovskaya-Fesenkova, Doctor of Physicomathematical Sciences, head of the Division of Atmospheric Optics of the Astrophysics Institute, Academy of Sciences Kazakh SSR. To date, she has taken personal part in 14 different expeditions, several of which worked under very difficult conditions, for example, in the Far Eastern taiga, on the desert of Sary Ishik Ottrau, in the region of dry winds near Pugachevska, on Kumbel' Mountain, Tien-shan, and others. She has great experience as an observer and has developed different methods for determining the optical properties of the atmosphere, which have been presented in various publications.

N. B. Divari, an Alpinist, a master of sports, also a participant in many expeditions. He is especially interested in the phenomena of zodiacal light and defended his candidate's dissertation on this problem. Under his supervision an electrophotometer for observing zodiacal light was constructed.

V. M. Kasachevskiy, scientific associate of the Astrophysics Institute, Candidate of Physicomathematical Sciences, head of the Chair of Physics at Alma-Ata Medical Institute. His dissertation concerned the difficult problem of photometry, determination of the albedo of the Earth by the ashen light of the moon. He was also a participant in many expeditions of the Astrophysics Institute of the Academy of Sciences Kazakh SSR and is a very close associate of Ye. V. Pyaskovskaya-Fesenkova.

P. N. Boyko, junior scientific associate of the Astrophysics Institute of the Academy of Sciences Kazakh SSR, who has taken part already in several previous expeditions of this institute. His part in the expedition to Egypt was to assist in observations, chiefly during daytime; photographic work; and work on adjusting and correcting electrical and mechanical equipment.

From the very beginning, as an essential condition to the success of the expedition the participation in the group of one of the Egyptian astronomers, preferably from the Helvan Observatory near Cairo, was planned by us.

## Instruments of the Expedition

All instruments of the expedition are of original design, completed by associates of the Astrophysics Institute and for the most part checked for a long time under diverse expeditionary conditions.

In 1955, V. I. Moroz, an associate at the institute, designed an automatic electrophotometer for observing zodiacal light in the night sky which was made in two copies by the Central Experimental Workshops of the Academy of Sciences USSR. Considering this, it was decided to reject this instrument which is more adapted to stationary conditions of operation. In its place, in the workshop of the Astrophysics Institute, under the immediate observation of Divari, another electrophotometer was made which was of simpler design and without automatic registration, but which operated on conventional batteries. However, this instrument, without fail, required two people for its manipulation, one for the installation and the other for readings of the mirror galvanometer.

This instrument is a vertical tube with appropriate optics directed at the zenith. The receiving area of the photomultiplier, which is always illuminated equally, is located in a Fabry pupil. The objective lens of the instrument is directed at various points of the sky with the aid of two large prisms with full internal reflection which are placed at previously fixed intervals according to the azimuth and the vertical arc. The cable connecting the photomultiplier with the amplifier and with the batteries is absolutely immovable. In the presence of an assistant, work with this instrument proceeds very rapidly and it requires little time for further reduction of obtained readings and for their conversion into corresponding absolute luminosities.

Other instruments of the expedition, which have been well-checked from their previous operation, included the following: A visual binocular photometer with mechanical registration suitable for photometric work on zodiacal light, and also for colorimetry and polarization measurements. The instrument is completely portable and the comparison area is provided by a luminophore of appropriate brightness. A day sky photometer, also of original design, which has been used in many expeditions of the Astrophysics Institute. An aureole photometer of old design and a second aureole photometer of new design of broken type. A theodolite for measuring geographic coordinates and determining the time, and various auxiliary small equipment. An ordinary Leica, equipped with a Zeiss Sonar f/1.5 lens with a focal length of 5 centimeters, is used as a photographic camera. Photographic film of very high sensitivity, namely RF3, was sufficient to obtain good photographs of zodiacal light with exposures of only 5 minutes.

In addition to the scientific instruments designated for conducting observations, the usual expeditionary equipment was supplied which might be needed under conditions of the Libyan Desert, such as various mechanical instruments, tents, awnings, white sun-reflecting awnings, topographic umbrellas, sleeping bags, camp beds, camp tables, and chairs and coarse felt blankets.

Further, various cooking utensils were taken, as well as office supplies such as tracing paper, paper, journals for recording observations, diaries, sketch books, graph paper, etc. Then, a fairly large assortment of different medicines and, finally, food products -- oat flour, powdered milk, rice, buckwheat, biscuits, and sugar were also taken along. The total weight of the entire expeditionary equipment, including scientific instruments, was nearly a ton (920 kilograms) and was sent from Alma-Ata to Moscow, then to Odessa, and finally by sea on the steamship Pobeda to Alexandria, Egypt, with the understanding that it would be transferred to Cairo to the address of our Embassy in the name of V. M. Kazachevskiy, a participant in the expedition.

The expedition left for Egypt on the steamship Pobeda, which left Odessa on 22 September. On 28 September, all members of the expedition arrived in Cairo.

Preparations in Cairo of Necessary Conditions for the Work of the Expedition in the Libyan Desert in the Aswan Region

Prior to our departure to Aswan, it was absolutely necessary to obtain appropriate orders from the various Egyptian authorities in Cairo, with respect to the necessary aid at the working site. Professor Samaha, director of the Helwan Observatory, took a major part with us in these tasks.

All members of the expedition visited Helwan Observatory and became acquainted with the scientific workers and the scientific equipment there. At this time, a polished and stained model of the Sikhote-Alinskiy meteorite and various scientific literature were presented as a gift to the Helwan Observatory from the Meteorite Commission of the Academy of Sciences USSR.

According to an agreement with Cairo University and Professor Samaha, the director of the Observatory, one of the astronomers of this observatory, Dr Adli As'ad, was assigned to work with the staff of our expedition. This was a great help to us and lightened our work in many respects. Dr Adli As'ad not only assisted N. B. Divari in all of his observations with the electrophotometer but also acted as an intermediary between us and the population, taking part in all dealings of our expedition with the various institutions and responsible persons, and he was also a translator from English to Arabic when this became necessary.

To acquaint Egyptian scientists with the tasks of our expedition and also with certain interesting investigations in the USSR bearing on the themes of the expedition, we delivered scientific papers in English and in French. The papers were delivered at the Faculty of Sciences at Cairo University, at Helwan Observatory, and in several other places. A list of the papers read follows:

V. G. Fesenkov, On the Nature of Interplanetary Matter and on Observations of Zodiacal Light (Faculty of Sciences of Cairo University).

V. G. Fesenkov -- Encounter of the Earth With a Minor Planet Producing the Falling of the Sikhote-Alinskiy Meteorite (Faculty of Sciences).

Ye. V. Pyaskovskaya-Fesenkova, Rapid Methods for Determining Atmospheric Transparency (Faculty of Sciences, Cairo University).

Ye. V. Pyaskovskaya-Fesenkova, On Certain Correlations of Brightness of the Day Sky (Faculty of Sciences).

N. B. Divari, Twilight as a Method of Investigating the Upper Atmospheric Layers (Faculty of Sciences).

V. G. Fesenkov, Investigations of Zodiacal Light and the Day Sky Conducted by an Expedition of the Academy of Sciences USSR in Aswan during October/November 1957 (Helwan Observatory).

Ye. V. Pyaskovskaya-Fesenkova, Certain Results With Respect to Atmospheric Transparency, Indicatrices of Scattering and Polarization Obtained in the Libyan Desert Near Aswan in October-November 1957 (Helwan Observatory).

V. G. Fesenkov, Astronomical Observation During the IGY and Scientific Significance of Artificial Earth Satellites (Soviet Embassy in Cairo).

V. G. Fesenkov, Growth of Astronomy in the USSR During the Past 40 Years After the October Revolution (for scientific associates and the professorial staff of Cairo University).

In addition, on request of Radio Cairo, I delivered a speech in French on the purposes of our visit in Egypt and on the artificial Earth satellites launched in the USSR.

Members of the expedition had a number of possibilities for contacts with Egyptian scientists. Certain leading scientists such as Professor Hammad and Professor Madwar invited us to their homes; we met others at special receptions which were given in honor of the arrival of the expedition, namely by the Minister of Education; the President of the National Committee on Scientific Research, Prof Turki; and by the rector of Cairo University.

I received from the Egyptian authorities in Cairo the necessary instructions addressed to the local governor in Aswan and to the head of the Aswan Dam with respect to the creation of the necessary conditions for work in that place. After this, on 10 October, N. B. Divari and Dr Adli As'ad set out for Aswan earlier than the rest of the staff of the expedition with their electrophotometer for finding a site suitable for observations and for finding proper living conditions for the entire expedition.

After several attempts, they finally found a completely suitable area for observations, namely at the extension of the road being constructed through the desert to the new High Aswan Dam which, at this time, is only being designed. Great difficulty under Libyan Desert conditions was found in grounding of electrical instruments. This grounding was made successful only by means of coupling the cable to an iron pipe which ran from the Nile River a distance of several kilometers to the site where the road construction work was being conducted.

In an area located at a distance of approximately 20 kilometers to the south of Aswan, rock columns were built for the installation of the instruments and also walls to protect them from wind and dust. Through the Governor of Aswan, a rest house located in a little village beside the dam itself on the right bank of the Nile was obtained from the authority of the Aswan Dam. The rest house contained five living-rooms, including a reception and dining room, two baths, and kitchen and had two servants, a cook and military guard housed in a military tent encampment around the perimeter of the territory of the rest house and continuously posted a guard. Another guard was provided for our expedition on the territory of the observation area itself and also was quartered in a permanent military tent encampment. As a consequence, in the observation area, it was possible to place all of our equipment necessary for field work and to go there for observations only at specified hours of the day or night, whenever it was most suitable. For this purpose, an automobile was assigned to us. For travel to the observation site, it was necessary to pass the dam, cross the Nile, and then travel around 12 kilometers to the south to the very end of the reconstructed road where the effect of city lights was absolutely undetectable.

## Activity of the Expedition and Preliminary Results

Regular observations were begun by members of the expedition after 17 October, that is, after the cessation of the light lunar nights. To the expedition was added, on her own request, Dr Imarah Sa'idah from the University in Heliopolis, who was interested in the works on atmospheric optics and became the diligent assistant to Ye. V. Pyaskovskaya-Fesenkova during her daytime observations. This made it possible to free Boyko from assisting in Ye. V. Pyaskovskaya-Fesenkova's observations and to detach him to photographic night work and partly to conduct observations with the aureole photometer alternately with Kazachevskiy. Daytime observations can, in such a manner, be conducted in two shifts -- before and after the middle period of the day, because for one and the same observer it would be impossible to work under Libyan Desert conditions when the temperature during the day rises to 45° centigrade and the surrounding granite rocks freed from sand cover become intensely heated.

In such a way, participation of Dr Imarah in a certain degree lightened the work of the expedition. In the interval between observations of Ye. V. Pyaskovskaya-Fesenkova, Dr Imarah obtained for herself a certain number of observational data with the day sky photometer.

The work routine of the expedition was as follows:

The day party, consisting of Ye. V. Pyaskovskaya-Fesenkova, Dr Imarah Sa'idah, and Kazachevskiy or Boyko, left for the observation area at 0500 hours -- that is, even before sunrise -- so that they could begin work at sunrise and conduct it continuously until 0900-0930 hours. By this time, all significant atmospheric masses had already passed. The second day party conducted observations usually only with the aureole photometer to obtain data for the evening observations, which were conducted by an observer who did not participate in the morning observations. The evening party, consisting of Fesenkova, Divari, and Dr Adli As'ad, departed at sunset and remained until daybreak, if the night was without a Moon. If there was a Moon, it was possible to leave later than sunset, but Divari and Dr Adli As'ad always appeared at the observation area at least 2 hours before the actual beginning of observations in order to switch on the batteries in good time, permitting them to become stabilized. The intensive heating of the batteries during the day, as a result of the high temperature of the air, caused a convective flow within them and disturbed the current stability. To store them at a sufficient depth to protect them from the daytime heating was impossible because the entire locality was composed of granite rocks which could only be blasted and not chiseled.

In general, working conditions were rather difficult, chiefly as a result of the intense heat and unusual dryness of the air and because the personnel had insufficient sleep. The day party particularly experienced difficult conditions.

As a result of the work, the following were obtained:

Binocular visual photometer (observer Fesenkov) -- General photometry of zodiacal light in the east and west according to the program mentioned above, study of pseudozodiacal light, and color and polarization at separate points of zodiacal light. The total number of determinations of brightness for 23 nights from 18 October to 24 November was 9,900.

Electrophotometer (observers Divari and Dr Adli As'ad) -- General photometry, photometric profile of the entire sky at different angular distances from the horizon, determination of color, measurements of polarization in the zodiacal light and in the entire sky, and determinations of the intensity of the brightness in the 5577 Angstrom emission line and in the adjacent section of the continuous spectrum of 5220 Angstroms with the aid of an interference filter. During 21 nights, from 19 October to 25 November 10,300 determinations of brightness were made.

Photometric camera (observer Boyko) -- In the general complexity of things around 50 photographs of zodiacal light, namely, its easternmost right branch, were made.

Day sky photometer (observer Pyaskovskaya-Fesenkova, assistant Dr Imarah Sa'idah) -- Indicatrices of scattering, coefficient of transparency, and polarization of the day sky at many points along the almucantar of the sun and continuously in the zenith. The total number of observations was around 5,000, from 17 October to 22 November.

Aureole photometer (Kazachevskiy and Boyko as alternate observers) -- From 19 October to 22 November, for 24 days, observations were made of 5,800 determinations of brightness of the aureole around the Sun in prenoon and afternoon hours of each bright day.

Observations could not be conducted when the sky was covered with cirrus clouds, which occurred frequently in November. One day, very dense clouds completely covered the entire sky and the Sun was not visible for several hours.

The night sky in the Libyan Desert to the south of Aswan is not distinguished by great darkness, and it is possible to see a great distance and to photograph the surrounding locality with a high-power objective lens with exposures of around 15 minutes. In spite of this, the star clouds of the Milky Way in a direction toward the center of the Galaxy defeat the Galaxy's brightness, which, of course occurs as a result of their high position above the horizon.

It is wonderful how the visible brightness of the zodiacal light depends on its inclination to the horizon, how this is revealed in comparison with its west and east branches. On a night in October immediately after twilight, the ecliptic is inclined 52° to the horizon approximately at the same angle as in the middle of August before sunrise in the region of Alma-Ata. But zodiacal light is in a high degree weak and dim, spreading to a considerable extent along the horizon in a northerly direction. On the other hand, the eastern branch of zodiacal light reveals itself in Aswan nearly normal to the horizon and far surpasses in brightness the very visible part of the Milky Way, at least in its parts closest to the Sun. This vast difference in brightness in the west and east branches, visible in the same night in Aswan, undoubtedly is connected with the huge increase of brightness of zodiacal light according to the closeness to the sun. In addition to this, it should be noted that the eastern branch of zodiacal light does not show the slightest propagation in a northerly direction; on the contrary, its northern contour is even more sharply limited than the southern contour as a consequence of the presence in the southern part of the sky of the Milky Way passing through the constellation Monocerotis and, consequently, is more intensive in this region of the sky of the gallactic component. As far as it is possible to judge, scintillation of stars in the Libyan Desert even near the horizon is very small and the quality of pictures should be very good; however, atmospheric absorption near the horizon is undoubtedly great. Only such bright lights as Jupiter can be seen on the horizon itself immediately after its setting. Stars of the first or second magnitude are revealed only at certain altitudes. At the same time, the general atmospheric absorption is quite small, particularly in view of the small height of the observation site above sea level -- around 200 meters. The measurements of Ye. V. Pyaskovskaya-Fesenkova indicate that the coefficient of atmospheric transparency in the Libyan Desert generally is no less than in the mountain regions of Alma-Ata at an altitude of around 1,500 meters. However, the region of the sky near the horizon in our deserts -- for example, in the Sary Ishik Ottrau Desert near Lake Balkhash -- is more transparent than in the region of Aswan. This difference is caused, evidently, by tropospheric dust, which is more sharply expressed in the south of Egypt. Observation conditions would be even more satisfactory if it were possible to get above this layer, being raised to a sufficiently high altitude.

Ye. V. Pyaskovskaya-Fesenkova found a number of interesting regularities with respect to the course of daytime transparency and degree of polarization, which will be discussed in detail in separate articles.

Preliminary investigation of observation data leads to the following conclusions: the observational aspect of zodiacal light depends not only on the superposition of various sources of light rising out of the upper layers of the atmosphere, out of the galactic component, but to a certain extent also on the luminescence of the troposphere caused by the zodiacal light itself. The observed but purely illusory stretching of zodiacal light inclined to the North, which repeatedly was noted previously, depends in all probability on the zodiacal twilight caused also by zodiacal light in itself, mainly its bright portions covered beyond the horizon.

Polarization of zodiacal light decreases with angular distance from the sun and is oriented, evidently, precisely in the direction of the Sun, at least in its normal position in relation to the horizon.

A review of photometric profiles conducted with the aid of an electrophotometer in the region of the 5577-Angstrom emission line and in the complex region of the spectrum around 5,200 angstroms does not indicate any kind of visible intensification of this emission line in zodiacal light.

The inclination of the axis of zodiacal light from the ecliptic, if it generally exists, should be absolutely insignificant.

The Gegenschein is slightly visible as a nearly circular dimmed spot, which at the end of October appeared in the vicinity of the Pleiades. The zodiacal band was also excellently visible and cut across the whole sky. Its brightness is comparable to the Milky Way in the region of constellation Monocerotis. It should be noted that around 0300 hours, when the Gegenschein passes into the western part of the sky and appears halfway from the horizon, the lower part of the zodiacal band always is distorted and produces the phenomenon of weak pseudozodiacal light which was noted previously in the Sary Ishik Ottrau Desert on Tuyuk Su Glacier and in other places. As the Gegenschein approaches the horizon, this phenomenon becomes invisible.

Arriving in Aswan, the expedition maintained communications with the Aswan authorities and Aswan society. Very frequently workers at the dam, the administration, engineers, and even the director of the Aswan Bank, who made our acquaintance, came as guests to our rest house. Twice the governor, accompanied by various officials, visited us. The governor of Aswan gave a dinner in honor of our expedition and arranged a tour of the various sites and a trip on a steamship on the Nile. The expedition, on its side, in connection with the 40th anniversary of the October Revolution, arranged a jubilee reception in a hotel in Aswan with a dinner to which, in addition to the governor, around 30 persons were invited.

After dinner, a visit to so-called Kitchener Island was made. An interesting botanical garden, which includes plants from all of Africa, has been cultivated there in recent times. In general, our expedition during its entire stay in Egypt appeared in a position as honored guests and was given the exclusive attention of the authorities and the population. All kinds of services were rendered us without charge -- the rest house, the automobile, the benzene for it, the chauffeur, servants, and even the steamship. When the expedition desired to travel up the Nile, transportation was provided free of charge for the entire day. The protection assigned to us was actually necessary, especially at the observation area; without it, the members of the expedition themselves would have had to continuously post a watch. At one time, our guards had to fire on 100 attacking jackals, which surrounded us.

With the advent of the period of lunar nights, when observations by night became impossible, the expedition in full complement went to Luxor, Karnak, and the Valley of the Kings and also visited the Coptic Orthodox Monastery and certain villages in the vicinity of Luxor.

After departure from Aswan, on 26 November, the expedition made a stopover in Qena. It twice crossed the Arabian Desert from Qena to the shores of the Red Sea, and further to Hardek, near which is located the well-known marine biological station. The expedition visited this station and collected diverse information and data. On the return to Cairo, the expedition during 1 1/2 days (4 and 5 December) traveled, in an automobile supplied by the Embassy, to the Suez Canal in Ismailia and further to Port Said, where it stayed over night. In the environs of Cairo and Aswan many places, interesting in one or another respect, were visited by the expedition.

Finally, on 8 December, the expedition went from Cairo to Alexandria, where the entire expeditionary cargo had previously been sent from Aswan. We were successful in putting the entire cargo, without delay, on the steamship Pobeda, on which it was returned to Odessa. Three of the members of the expedition returned to the Soviet Union on this steamship. The remaining two had flown much earlier to Prague on a Swissair plane, and then from Prague to Moscow on a TU-104.

The tasks of the expedition include not only conducting observations appropriate to the IGY program, but also establishing scientific relations with Egyptian scientists, acquainting them with certain achievements of Soviet science, and adopting measures to permit the work on observations of zodiacal light, according to our program, to continue in Egypt after our departure. Bearing this in mind, before our departure we had foreseen the possibility of leaving our electrophotometer in Egypt on condition that the work of this instrument would be continued by the members of the Helwan observatory.

The electrophotometer was transferred to the Helwan Observatory in a special meeting in Helwan on 2 December, with the participation of correspondents and representatives of the Soviet Embassy. N. F. Vinogradov, the Embassy's first secretary for political affairs, characterized the arrival of our expedition in Egypt and the transfer of the electrophotometer to Helwan Observatory as a substantially real bond in the scientific sense between the two countries. The Helwan Observatory proposed to begin immediately the transfer of its magnetic division, which cannot work well in Helwan because of magnetic disturbances. At the proper moment our instrument can be set up at the meteorological station now in existence in Fayum.

Dr Adli As'ad, who through many nights assisted Divari on this instrument and became familiar with its operation, can now continue its operation independently, which of course is his own desire.

On 6 December, knowing we were still in Cairo, Dr S. Hamid, also from the staff of Helwan Observatory, told us that he also was interested in this work and wished to take part in it.

During our stay in Aswan, Professor Samaha, director of Helwan Observatory, and Professor Hammad, head of the Chair of Applied Mathematics at Cairo University, specially engaged in atmospheric optics, spent 3 days with us. They became acquainted in detail with the work of all of our apparatus under field conditions at the observation area. Professor Hammad's work has been purely theoretical and he is extremely interested in organizing in Egypt regular observations on atmospheric optics.

In conclusion, I note that the expedition of the Academy of Sciences USSR in Egypt for observing zodiacal light and the optical properties of the atmosphere was rather successful. All members of the expedition returned in good health. They collected a great amount of observational material -- around 30,000 observations, which now should be processed and discussed. They established very good relations with Egyptian scientific circles and prepared conditions for future continuation of our work in Egypt, with our instruments and according to our program. They made many personal acquaintances, which may assist the future development of cultural relations with Egyptian scientific circles.

[The report by Fesenkov is accompanied by a map showing the exact location of the observation station outside of Aswan as being 23°58.9' North latitude and 32°51.6' East longitude.] (Astronomicheskiy Zhurnal, No 2, Mar/Apr 58, pp 305-313)

## Soviet Monthly Review Gives Cosmic Data for October 1957

Kosmicheskiye Dannyye (Cosmic Data), No 10 (20), 1957, a monthly review issued by NIZMIR (Scientific Research Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation) of the Ministry of Communications USSR, contains data for October 1957 of the results of observations on geophysical phenomena concerning the electric and magnetic state of the upper atmosphere: geomagnetic variations, the ionosphere, cosmic rays, and earth currents.

The editorial board consists of the following members of NIZMIR: N. P. Ben'kova, responsible editor and a Doctor of Physicomathematical Sciences; T. S. Kerblay and Ye. S. Glokova, Candidates of Physicomathematical Sciences; V. D. Davydov; N. V. Mednikova; L. G. Mansurova; O. P. Gorodnicheva; and B. S. Shapiro.

Information concerning solar activity and solar radio emissions which were given earlier in Kosmicheskiye Dannyye in the form of tables and diagrams are presented in abbreviated form solely for comparison with geophysical data.

The table headings are given in both Russian and English.

According to this monthly review, the sharp increase of solar activity which began in June of 1957 continued in October. The activity was comparatively equally distributed over the Sun's disk. The appearance of new active foci of disturbances was noted. However the geoeffectiveness of the active regions rarely declined. In contrast to September 1957, during which four periods of very strong magnetic atmospheric disturbances were observed, October is characterized by a calm state of the magnetic field and the ionosphere. In the beginning of the month, negative ionospheric disturbances were observed which were the end of the very strong storm of the last of September. The magnetic disturbance was completely ended in the first hours of 1 October. During the month it is possible to single out 3 weakly disturbed periods:

10-15 October

From 6 October to 13 October, three active regions passed through the central meridian. Region No 62, a steady active region in its last revolution, produced an intensive magnetic-ionospheric disturbance. During the revolution, it decomposed; the active spot and flare area decreased significantly. Chromospheric activity was still sufficiently high (3 flares were noted in the region), but the geoeffectiveness of the area was considerably lessened. An extraordinarily stable active region in the southern hemisphere No 63 (during the last revolution No 59), observed on the 20th revolution of the Sun, continued disintegrating. Region 64, a new growing active region, in its last revolution, presented its own separate spot. From regions 62 to 64, two of the small negative ionospheric disturbances and a small magnetic storm with a sudden beginning (2038Z on 13 October) were connected. Small disturbances with abrupt beginnings (2038Z) were also observed in Earth currents.

17-19 October

The 13-18 October stable active region No 65 (in the last revolution No 60) passed through the Central Meridian. In the southern hemisphere during this same time, a new, quickly developing region No 66 was observed. Both regions were almost nongeoeffective. Only two small disturbances of short duration were observed in the ionosphere. The magnetic field was completely calm.

21-23 October

Small magnetic storms with unexpected beginning (2042Z) on 21 October) were connected with the stable active region No 67 (Central Meridian 22-26 October). The first period of the storm was characterized by the great liveliness of elements which foretold the large storm. However, the storm did not develop. The amplitudes of the disturbance were small. Similar disturbances were observed in Earth currents. (Kosmicheskiye Dannyye, No 10 (20), Oct 57, p 1-6)

## Arctic Drift Station Severnyy Polyus-7

For the past 3 months, the staff of Severnyy Polyus-7 has been conducting scientific observations, according to plan, in the high latitudes of the Central Arctic. On 18 June, Severnyy Polyus-7 crossed the 87th degree northern latitude, and continued to drift toward the 88th degree. All the work at the station is done according to the IGY program in the fields of oceanology, ionosphere, aerology, meteorology, and actinometry, as well as terrestrial magnetism. The work in the field of oceanology has been considerably expanded over that of 1957, by increasing the amount of ice observations.

Severnyy Polyus-7 scientists have obtained new data in the study of the bottom relief of the Arctic Ocean. On 15 June, a new elevation of the ocean bottom was discovered; the ocean depth at this place was measured at 1,495 meters, while the surrounding level of the ocean bottom was 2,600 to 2,700 meters deep. The relative height of this elevation above the surface of the ocean bottom is 1,100 to 1,200 meters. An analysis of all previously measured depths in this area shows that a new mountain range has been discovered which, according to existing data, is a spur of the central arctic elevation. The length of the mountain range is about 560 kilometers.

During the period of the drift, the station has traveled over 150 miles; however, on a straight line the distance is not more than 50 miles. According to preliminary data, the ice drift in the area of Severnyy Polyus-7 is determined mainly by the direction of the wind.

In connection with the unusually early summer of 1958, a heavy thaw set in. As a result, large lakes of melt water were formed quickly, which surrounded the station buildings. By taking the necessary precautions, it was possible to drain several thousand tons of water through the ice in a short period, thereby safeguarding the normal operation of the station. -- N. Belov, chief of Severnyy Polyus-7 (Moscow, Vodnyy Transport, 1 Jul 58)

## Oceanographic Research in the Arctic

The scientific observations under the IGY program include a large amount of oceanographic research in the arctic seas. First of all, observations were conducted in the Greenland Sea and the adjacent parts of the Arctic Ocean, as a result of which valuable data were obtained on the water and ice exchange between the Central Arctic basin and the Greenland Sea through the wide strait between Spitsbergen and Greenland.

The preliminary results of processing the collected scientific material show that the edge of the ice pack has advanced considerably to the north in the Greenland Sea, and that a small amount of ice was being carried out of the Central Arctic basin through the Greenland Sea. The oceanographic work conducted in the northern part of the Greenland Sea on the Ob' and Lena has confirmed the existence of a deep channel (up to 3,000 meters deep) in the submarine elevation called the "Nansen Porog" in the center of the strait between Greenland and Spitsbergen, which plays an important part in the water exchange between the North Atlantic and the Central Arctic basin.

The observation materials of the station Severnyy Polyus-7, collected in some of the little known regions of the Arctic Ocean, are also extremely valuable. The drift of this station, in the direction of the Canadian archipelago, is in keeping with the general ice conditions in marginal arctic seas, east of Novosibirskiye Ostrova. It definitely proves the existence of a closed (loop) ice circulation in a clockwise direction, in the part of the Arctic Ocean adjoining the Pacific. This ice circulation is closely connected with the general atmospheric circulation above the Central Arctic basin. -- A. Dralkin, chief of Division of Science and Hydrography, Main Administration of Northern Sea Route (Moscow, Vodnyy Transport, 1 Jul 58)

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## Bering Sea Expedition

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The trawler Ogon', lead ship of the Bering Sea scientific and fishing expedition, left Avachinskaya Bukhta and headed for the ocean. In an interview with a Tass correspondent, Candidate of Technical Sciences V. Gordeyev, deputy chief of the expedition, stated that the main purpose of the expedition was to study the distribution, accumulation density, and migration of fish, taking into account the oceanological conditions. The Bering Sea region is comparatively new for fishing operations. This region will now be explored for scientific purposes and at the same time active trawling operations will be organized. The scientific research ships will be followed by fishing vessels.

The scientists will also give a description of the sea water, currents, deep-sea fauna, and the composition and structure of the sea bottom. Part of the work is being done within the IGY program.

There has never before been such a large expedition in this extensive region of the Pacific basin. The expedition includes about 30 scientists of different specialties. Among them are the well-known ichthyologists, Professors P. A. Moiseyev, A. G. Kaganovskiy, and T. S. Rass. (Moscow, Vodnyy Transport, 3 Jul 58)

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## Report From Antarctic Station Komsomol'skaya

During the first 20 days of June 1958, the average temperature recorded at Komsomol'skaya was minus 67.5 degrees centigrade. At noon of 17 June, an interesting phenomenon was observed for the first time. During a severe frost, the northern half of the firmament, where the sun was hidden behind the horizon, acquired a deep crimson color. At the horizon the color changed over into bright yellow and in some places into emerald. The whole range of colors, especially near the horizon, was iridescent and various shades intermingled. Such a phenomenon had never been observed previously in the Arctic by any of the expedition members.

Another unusual phenomenon observed by the antarctic expedition members is the cracking of the snow surface under the influence of very low temperatures. Cracks up to 3 centimeters wide and over 2 meters deep are formed. The formation of these cracks is accompanied by loud noises resembling thunderclaps or even explosions. Sometimes these "explosions" are so strong that the station buildings tremble. At such times the instruments indicate marked changes in atmospheric pressure. -- Mikhail Fokin, chief of station Komsomol'skaya (Moscow, Izvestiya, 3 Jul 58)

## Report From Antarctic Station Pionerskaya

The Antarctic Station Pionerskaya recently celebrated the 2-year anniversary of its operation. This station is located in a zone where the glacial "run-off" winds originate. During May, there was not a single day without a snowstorm. The buildings of the settlement are connected by subsnow passages and tunnels. In some places the ceilings of the huts and the tunnel supports have caved in under the weight of the snow masses. New supports had to be built similar to those in coal mines and arched snow vaults were built above the ceilings to support heavy loads.

The snow dust, driven by strong winds, electrifies the antennas of the radio station, the instrument wires, and all the apparatuses of the electromagnetic system. Sparks between the terminals of the radio receiver and the antenna sometimes jump over a gap of 5 centimeters. During a heavy wind, the men's clothing also becomes charged with electricity. -- Grigoriy Silin, chief of station Pionerskaya (Moscow, Izvestiya, 3 Jul 58)

## Ob' Returns to Antarctic

After leaving Chile, the Ob' headed again for the Antarctic, to the Drake Strait. For 5 days, the members of the antarctic marine expedition conducted research in this strait between Terra del Fuego and Antarctica.

The meteorological ice conditions in this area have grown considerably worse, but the work of the expedition went on without interruptions. On 10 June, the Ob' approached the southernmost point of the oceanological profile near Mordvinov Island (or Elephant Island), one of the South Shetland Islands, discovered in 1821 by the Russian navigators F. F. Bellingshausen and M. P. Lazarev.

The biologists of the expeditions were able to do some successful trawling at this station, collecting valuable material from a depth of 400 meters, including various beaker-shaped glass sponges, rose-colored hydrocorallinae, echinoidea, starfish, and other representatives of antarctic fauna. The valuable specimens are being sorted and prepared for museums by the biologists F. N. Pasternak and V. M. Koltun.

Professors A. P. Andriyashev and Yu. Ye. Permitin, the ichthyologists of the expedition, have obtained for the first time on this trip large specimens of a rare variety of "horned" white-blooded pike. These fish of the family of white-blooded pike differ from all other types of fish in that they have colorless blood, which has no red blood corpuscles and hemoglobin whatsoever. An analysis of the blood of these fish shows that it is transparent, like water. Until now, these fish have presented a mystery to scientists.

From Mordvinov Island, the Ob' proceeded on 10 June in a northerly direction, continuing to operate in the profile in the eastern part of Drake Strait as far as the southeast point of Terra del Fuego. From here on, the Ob' will be on its homeward voyage. (Moscow, Sovetskiy Flot, 17 Jun 58)

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