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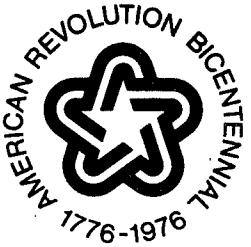

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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 383

This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. ASTRONOMY

News

RATAN-600 RADIOTELESCOPE DESCRIBED

Leningrad LENINGRADSKAYA PRAVDA in Russian 8 August 1976, p 2

[Article by Yu. Stvolinskiy, "Face to Face with the Universe"]

[Summary] Traditional methods for creating radiotelescopes made it impossible to construct instruments except of a relatively small size. One of the solutions to this problem was the antenna with a variable profile, proposed by Pulkovo scientists. Using this design it was possible to construct a gigantic antenna from a large number of individual reflectors by arranging them in a circle. Such an antenna was used in the great RATAN-600 radiotelescope, which has 900 reflectors. Each of these is an enormous metal "dish" with a rectangular configuration. Each measures 2 x 7 1/2 meters. They are attached to stable supports which rest on concrete pillars which are embedded into the very stable natural foundation. Each reflector can be turned on two axes and moved some distance forward and backward. But these reflectors are not simple panels; each of them has dozens of points which can be regulated individually. By using them it is possible to obtain from the individual panels a precise parabolic surface which in turn focuses the radiation on the receiving antenna at the center of the circle. The deputy chief designer of the telescope, Doctor of Physical and Mathematical Sciences N. A. Yesepkin, states: "The advantage of the RATAN design in comparison with ordinary parabolic antennas is that a greater accuracy can be achieved in the setting of individual reflectors than in a single metal structure. The RATAN is 'flexible,' and this makes it possible to observe radio emission sources in the entire upper hemisphere, and it allows different observation regimes. Important advantages are given by the possibility of changing the antenna profile; it can operate in individual sectors, observing several objects in different directions. The high accuracy achieved in fabricating the reflector panels ensures observations at wavelengths from 30 cm to 8 mm. During 1966-1967 the planning of the RATAN took place, followed by its construction. Near the RATAN there is a small building which is literally crammed with instruments. In the near future electronic computers will make it possible to accompany objects

moving through the celestial sphere. It has been two years now since the first observations began. For the time being observations are being made using the northern sector. The southern sector is being adjusted. Many hundreds of observations have already been made at wavelengths of 2, 4, 6 and 21 cm. New data have been obtained on the sun, moon, planets and their satellites, quasars, radiogalaxies and variable sources. The deputy director of the Special Astrophysical Observatory, Doctor of Physical and Mathematical Sciences Yu. N. Pariyskiy, reports that the RATAN-600 has been employed in investigating the early stages in evolution of the universe. Unique data have been obtained suggesting that many hypotheses on formation of galaxies and other structural forms in the universe contradict the observations with the new radiotelescope. Now the Pulkovo Observatory does not have a division of radioastronomy as such. The senior center of celestial science in the USSR has "handed over" this division to the Special Astrophysical Observatory, a new observatory of two giants -- the six-meter BTA and the 600-m RATAN.
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Abstracts of Scientific Articles

BRIGHTNESS COEFFICIENTS OF TWO-LAYER ATMOSPHERE

Yerevan ASTROFIZIKA in Russian Vol 12, No 1, 1976, pp 83-94

[Article by A. K. Kolesov, Leningrad State University, "Brightness Coefficients of a Two-Layer Atmosphere in Cases of Isotropic Scattering. I"]

[Abstract] In the theory of radiation transfer in the atmospheres of stars and planets it is usually assumed that the atmosphere consists of plane-parallel layers whose optical properties do not change with depth. In real atmospheres the optical properties can be highly dependent on depth. The diffusion of radiation in such inhomogeneous media has been studied to a lesser degree than in homogeneous media. The simplest special case of an inhomogeneous medium of practical interest for astrophysics and geophysics is the case of a two-layer atmosphere. Accordingly, the author has investigated the nonisotropic scattering of light in an atmosphere consisting of two homogeneous plane-parallel layers with different scattering functions and different optical thicknesses and albedos of the particles. It is assumed that the atmosphere is illuminated by a beam of parallel rays incident from the outside. The intensities of the radiation emanating from the atmosphere and the radiation at the boundary between the layers are expressed through the auxiliary functions of one angular variable.
[222]

II. METEOROLOGY

News

ARTICLES ON ATMOSPHERIC BOUNDARY LAYER

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B46K
[Abstract (contents) of collection of articles POGRANICHNYY SLOY ATMOSFERY, TRUDY INSTITUTA EKSPERIMENTAL'NOY METEOROLOGII GUGMS, No 10(53), Moscow, Gidrometeoizdat, 1975, 172 pages]

[Text] This collection of articles contains papers on investigation of the boundary layer of the atmosphere over the land and water surface. On the basis of the results of special measurements on the high meteorological mast it was possible to determine the conditions for the appearance of mesoscale convection; the authors give the characteristics of cooling and the statistical characteristics of fluctuations of wind velocity and temperature during summer radiation inversions; the characteristics of atmospheric fronts were obtained using a more frequent schedule of soundings in the free atmosphere. In papers of an applied direction the authors examine the influence of nonuniformity of the underlying surface on wind velocity, the correlation between changes in wind velocity at the levels 8 and 300 m, the dependence of vertical temperature gradients on cloud cover, horizontal variability of the wind in a distance of 50 km; there is an evaluation of the horizontal nonuniformity of the refractive index for ultrashort waves on atmospheric fronts. For the purpose of parameterization of exchange processes a model of the boundary layer with nonlinear boundary conditions and integral expressions has been developed. Using numerical models, a study was made of the influence of initial conditions on the development of cellular convection, feedbacks stabilizing convection, and also the dependence of nighttime radiation cooling on initial conditions. Also examined is a model of the influence of thermal inhomogeneity of the ocean on the boundary layer of the atmosphere in the Trades zone; results are given on measurements of the turbulent regime of the near-water layer of the atmosphere. In conclusion data are given from measurements representing examples of daily and frontal changes in meteorological parameters in the 300-m layer. Contents: L. I. Petrova -- "Conditions for the Appearance of Mesoscale Convection in the Atmospheric Boundary Layer"; N. L. Byzova and G. Ye. Mamayenko -- "Characteristics of Cooling of the Atmospheric Boundary Layer During

Radiation Inversions"; N. L. Byzova and T. A. Kalinicheva -- "Statistical Characteristics of Fluctuations of Temperature and Wind Velocity During a Radiation Inversion"; N. L. Byzova and B. M. Matkovskiy -- "Characteristics of Atmospheric Fronts in the Lower Part of the Troposphere on the Basis of the Results of Complex Measurements"; I. V. Nekrasov and T. V. Rostkova -- "Influence of Nonuniformity of the Underlying Surface on the Wind Velocity Profile"; L. M. Khachaturova and V. G. Tsverava -- "Correlation Between Changes in Wind Velocity at Heights of 8 and 300 m and at Great Velocities"; N. M. Kireyeva and N. P. Yasevich -- "Weight Concentrations of Atmospheric Aerosols in Air Masses During Summer and Autumn 1972"; G. B. Mashkova -- "Characteristics of Stratification of Air Temperature in the Lower 300 m of the Atmosphere"; E. Ye. Vyal'tseva -- "Horizontal Nonuniformity of the Refractive Index of Air for Ultrashort Waves in Atmospheric Fronts"; A. F. Filofeyeva -- "Mesoscale Spatial Variability of the Wind"; V. V. Galushko and A. Ye. Ordanovich -- "Parameterization of Exchange Processes in the Boundary Layer of the Atmosphere Within the Framework of an Integral Ekman Model"; I. M. Zakharova -- "The Relationship Between Radiant and Turbulent Heat Exchange in the Atmospheric Boundary Layer Under Stable Stratification Conditions"; V. N. Ivanov and A. P. Khain -- "Some Feedbacks Arising in the Turbulent Atmosphere During the Development of Cellular Convection"; A. P. Khain -- "Influence of the Initial Temperature Impulse and Relative Humidity on the Development of Convection for Different Temperature Gradients"; V. N. Ivanov and L. Kh. Ingel' -- "Structure of the Atmospheric Boundary Layer in the Trades Zone"; L. I. Petrova, A. D. Gutorov, T. F. Masagutov and V. D. Pudov -- "Some Results of Investigation of the Turbulent Regime of the Near-Water Layer of the Atmosphere"; "Examples of Change in Meteorological Parameters in the Lower 300-m Layer of the Atmosphere."
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ARTICLES ON POLAR ATMOSPHERE AND LONG-RANGE FORECASTING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B54K

[Abstract (contents) of collection of articles OSOBENNOSTI ATMOSFERNYKH PROTSESSOV V POLYARNYKH OBLASTYAKH I DOLGOSROCHNYYE METEOROLOGICHESKIYE PROGNOZY, TRUDY ARKT. I ANTARKT. NII, 300, Leningrad, Gidrometeoizdat, edited by L. A. Dydina, A. A. Girs and V. A. Yefimov, 1976, 176 pages]

[Text] Contents: "Foreword"; L. A. Dydina, S. V. Rabtsevich, L. Yu. Ryzhakov, G. B. Savitskiy -- "Forms of Atmospheric Circulation in the Southern Hemisphere"; L. Yu. Ryzhakov -- "Some Characteristics of Anomalous Development of Forms of Atmospheric Circulation in the Southern Hemisphere in the Cold Season of the Year"; G. B. Savitskiy -- "Types of Synoptic Processes in Antarctica in Relation to Forms of Atmospheric Circulation in the Southern Hemisphere"; V. A. Yefimov -- "Use of the Principles of the Macrocirculation

Method in Hydrodynamic Long-Range Forecasting"; G. I. Reynoyuk -- "Spectral Analysis of Tensor Characteristics of Macroturbulence in the Atmosphere"; M. P. Yevseyev -- "Investigation of Extremal Values of the Eigenfrequencies of Free Oscillations of a Barotropic Atmosphere"; V. A. Yefimov and G. I. Reynyuk -- "Predicting the Components of the Macroturbulence Tensor"; V. K. Kurazhov -- "Study of the Vertical Structure of Characteristic Oscillations of the Atmosphere in a Real Stratification"; V. A. Yefimov -- "Use of the Methods of Mathematical Modeling for Studying the Transformed Form of Atmospheric Circulation"; A. V. Kuznetsov and G. I. Reynyuk -- "On the Problem of the Information Content of Tensor Characteristics of Macroturbulence for Predicting Synoptic Processes for a Short Time in Advance"; A. A. Dmitriyev and N. A. Ivanov -- "On the Extremal Development of Some Centers of Action in the Atmosphere and the Influence Exerted on Them by Forces of Geophysical and Tidal Origin"; S. I. Kondratyuk -- "On Stability of the Sign of Change in Pressure Within Elementary Synoptic Processes and Between Them"; M. I. Galaktionova -- "Some Quantitative Characteristics of Transformations of the Principal Forms of Atmospheric Circulation."
[11]

SYMPOSIUM ON STATISTICAL METHODS IN METEOROLOGY

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 12, No 8, 1976, pp 895-896

[Article by L. V. Rukhovets, "Second All-Union Symposium on the Use of Statistical Methods in Meteorology"]

[Abstract] The Second All-Union Symposium on the Use of Statistical Methods in Meteorology was held in Leningrad (at the Main Geophysical Observatory) during the period 11-13 November 1975. The symposium was attended by more than 200 specialists. The symposium was devoted for the most part to problems in long- and intermediate-range forecasting. Section meetings were devoted to four themes. 1. Statistical modeling of large-scale atmospheric processes. 2. New stochastic and statistical approaches to weather forecasting (theory of statistical solutions, image recognition, etc.). 3. Requirements on the representation of information necessary for weather forecasting. 4. Methods and results of evaluations of the information content of prognostic indications and forecasting methods and also the economic effectiveness of forecasts. More than 50 reports were devoted to these subjects. The reports dealt with the statistical description of the spatial and temporal distributions of meteorological elements and its use in forecasting. Several reports dealt with the use of regression models, including nonlinear models. A considerable number of reports dealt with complex forecasting methods: the Main Geophysical Observatory physical-statistical method, the synoptic-hydrodynamic-statistical method, dynamic-stochastic method, and others. A series of reports was on different methods for evaluating

the information content of observation systems and the predictors used in prognostic models. The conferees recommended that efforts be combined for solving the following problems: a) formulating hydrodynamic-statistical theories of processes in the earth-atmosphere system; b) combining and making objective the results of investigations in the field of hydrodynamic, statistical and synoptic forecasting methods. A resolution noted the need for broadening investigations directed to obtaining the objective characteristics of hydrometeorological processes and fields, investigations in the field of optimum representation and the strategy of use of forecasts, including in stochastic form. There is a need for accelerating work on creating a data bank meeting the requirements of the principal directions in the field of long-range forecasting. It was decided to hold symposia on the use of statistical methods in meteorology each three years and also annual specialized conference-seminars on long-range forecasting.
[200]

Abstracts of Scientific Articles

DETERMINING HAIL SIZE IN CLOUD

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B115

[Abstract of article by A. D. Dzhurayev, A. F. Igumentsev and T. V. Sevast'-yanova, "Determining the Size of Hail in a Cloud Using a Single-Wavelength Radar Set"; -- TRUDY SREDNEAZ. REGIONAL'N. N.-I. GIDROMETEOROL. IN-TA, No 30 (III), 1975, pp 35-39]

[Text] A study was made of the possibility of determining the diameter of hail in a cloud using a single-wavelength radar set. For this purpose the author formulated a multifactor algorithm which takes into account the influence of three factors (maximum radar reflectivity, temperature at the upper boundary of the zone of increased reflectivity, temperature at the upper boundary of the reflection zone). A nomogram constructed on the basis of the multifactor algorithm for determining the size of hail in a cloud affords a possibility in a minimum time to estimate the diameter of hail in a cloud. Bibliography of five items.
[11]

CLOUD STRUCTURE EFFECT ON LASER RADIATION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B258

[Abstract of article by L. G. Akul'shina, O. A. Volkovitskiy and G. I. Shchelchkov, "Effect of Microstructure of the Cloud Medium on the Duration of its Clearing by Laser Radiation"; Moscow, TRUDY IN-TA EKSPERIM. METEOROLOGII GUGMS, No 13(58), 1976, pp 178-184]

[Text] A study was made of the influence of the microstructure of the cloud medium on the duration of its clearing by laser radiation of a CO_2 laser. Experiments with the directed change in microstructure of a fog were carried

out in the large aerosol chamber at the Institute of Experimental Meteorology. The experimental results were compared with the theoretical computations. It is shown that the time for evaporation of the cloud medium during its clearing by radiation with $\lambda = 10.6 \mu m$ is slightly dependent on the radius of droplets in the size range from 2 to 10 μm. Bibliography of 8 items.
[11]

MAN'S EFFECT ON ATMOSPHERE AND CLIMATE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B621

[Abstract of article by F. F. Davitaya, "Effect of Anthropogenic Factors on Earth's Climate and Atmosphere"; Moscow, KLIMAT-GOROD-CHELOVEK, "Znaniye," 1975, pp 31-53

[Text] F. F. Davitaya examines different aspects of the influence of human activity on climate. In order to prevent changes in gas composition the author proposes different ideas and methods for the purpose of increasing the intensity of photosynthesis. The article sets forth measures for developing methods for predicting increased air contamination, for organizing a warning system, for monitoring fertilizer application, for chemical control of weeds, pests, diseases, etc. Worthy of special consideration is the problem of ensuring a stable gas composition of the atmosphere. An acute need is arising for the direct use of solar radiation for energy purposes. Scientific efforts must be directed to the creation of a fundamentally new production technology.
[11]

HAIL PREDICTION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B454

[Abstract of article by I. A. Savchenko and G. K. Sulakvelidze, "On the Problem of Hail Prediction"; --, TRUDY SREDNEAZ. REGIONAL'N. N.-I. GIDROMETEOROL. IN-TA, No 30 (III), 1975, pp 32-34]

[Text] On the basis of observational data for Dushanbe the authors have obtained an empirical dependence between temperature at the condensation level ($T_{c.l.}$) and the temperature difference between cloud (rising) and the surrounding air at the level of the isotherm -20° (ΔT_{-20}) on the one hand and the type of falling precipitation (hail, showers, without precipitation) on the other. In 90% of all cases hail falls when $T_{c.l.}$ is in the limits from 4 to 13° and ΔT_{-20} exceeds 3°. A graph is constructed which makes

it possible to prepare a hail forecast using the $T_{c.l.}$ and ΔT_{-20} values (the regions of presence and absence of hail are separated by a demarcation line). The mean probable success of the forecast, according to data for two years of routine work in the Gissarskaya and Fergana valleys, was 76% for the presence of hail and 97% for its absence. Bibliography of 8 items.
[11]

SUCCESS OF FORECASTS OF DANGEROUS PHENOMENA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B416

[Abstract of article by L. G. Shtul'man and V. L. Gorokhova, "Probable Success of Forecasts of Dangerous Weather Phenomena Under Conditions of Work of an Antihail Detachment"; Moscow, TRUDY VYSOKOGORN. GEOFIZ. IN-TA, No 31, 1976, pp 104-110]

[Text] Methods for the prediction of hail, thunderstorms, showers and squalls developed at the High Mountain Geophysical Institute are described (see RZhGfiz, 1971, 5B54; 1973, 5B367, and others). An evaluation of the probable success of these methods by protected and control regions in the area serviced by the Northern Caucasus Antihail Expedition during the summer seasons 1972-1974 on the basis of data from several meteorological and radar stations of the expedition is given. The accuracy of computations by all the considered methods is dependent to a high degree on the correctness of construction of the prognostic curves of temperature and humidity; this is difficult in areas of complex relief. The article gives the characteristics of probable success of these forecasting methods, indicating their adequate reliability when put into practical use.Bibliography of 6 items.
[11]

ATMOSPHERIC CIRCULATION AS AN OSCILLATORY PROCESS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 7, 1976, 7B359

[Abstract of article by A. A. Girs and V. A. Yefimov, "The Earth's Atmospheric Circulation as an Oscillatory Process and Investigation of its Peculiarities According to Polar Experiment Data"; Leningrad, PROBLEMY ARKTIKI I ANTARKTIKI, No 47, Gidrometeoizdat, 1976, pp 44-54]

[Text] A study was made of the role of the polar regions in the problem of global investigations of atmospheric and oceanic circulation. The authors define the range of problems associated with formulation of the theory of

transformation of the principal forms of circulation on the basis of a hydrodynamic model capable of describing the mechanism of energy transfer in the spectrum of wave perturbations with the influence of the polar regions taken into account. The authors propose a complex of observations which if implemented would make it possible to deepen our knowledge of baroclinic nonadiabatic factors in the complex mechanism of nonlinear energy interaction of waves and also in improving the hydrodynamic model of long-range forecasting for the polar regions. Bibliography of 8 items.
[11]

STRUCTURE AND EVOLUTION OF THUNDERSTORM-HAIL PROCESSES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 7, 1976, 7B252

[Abstract of article by M. T. Abshayev and Kh. A. Imamdzhanov, "Some Peculiarities in the Structure and Evolution of Thunderstorm-Hail Processes"; --, TRUDY SREDNEAZ. REGIONAL'N. N.-I. GIDROMETEOROL. IN-TA, No 35(116), 1975, pp 13-28]

[Text] The authors investigated the structure and evolution of thunderstorm-hail cloud systems in the example of seven cases. Individual clouds of the frontal system usually consist of several elements which exist from 15 to 200 minutes with an average lifetime of 30-60 minutes. They arise periodically on the right flank in the region of the extended radio echo "hook" and are destroyed on the left flank. The merging of the two elements occurs by means of formation in them of a common zone of ascending currents and it does not lead to an appreciable change in the intensity of the processes. The elements for the most part move to the left relative to movement of the entire complex, whereas it itself rotates counterclockwise with a velocity of 0.1-0.2 revolution per hour. Bibliography of 3 items.
[11]

LASER PROPAGATION IN CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B289

[Abstract of article by V. A. Bel'ts, O. M. Matveyev and V. P. Nikolayev, "Investigation of Thermal Refraction in Propagation of the Beam of a CO_2 Laser in Fogs"; Moscow, TRUDY INSTITUTA EKSPERIMENTAL'NOY METEOROLOGII GUGMS, No 13(58), 1976, pp 139-146]

[Text] This paper gives the results of experimental investigations of refraction in individual zones of the cross section of a beam of laser radiation propagating in artificial and crystalline fogs for a broad range of ambient temperatures in dependence on the level of optical density and the velocity of air currents in the direction perpendicular to the direction of beam propagation. Data from refraction measurements were used in constructing transverse temperature profiles in the zone and in the neighborhood of the laser radiation beam and it was possible to estimate the maximum relative heating for the investigated temperature range. Bibliography of 13 items.
[11]

ACCURACY OF RADAR MEASUREMENTS OF QUANTITY OF PRECIPITATION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B116

[Abstract of article by L. M. Volynets and T. N. Zabolotskaya, "Estimating the Limiting Accuracy of Radar Measurements of the Quantity of Precipitation"; Moscow, TRUDY UKR. N.-I. GIDROMETEOROL. IN-TA, No 114, 1976, pp 125-134]

[Text] The paper cited above discusses radar measurements of the quantity of precipitation by two methods: on the basis of reflectivity and on the basis of attenuation in the wavelength range 0.86-10 cm. For estimating the limiting accuracy of radar measurements the authors use data on the spectra of droplets in 78 rains (971 spectra). The limiting accuracy of these measurements is determined using the relative and mean square relative error in measuring the layer of precipitation during a rain. Simultaneously it is possible to check the condition of coincidence of the total layers of precipitation computed on the basis of reflectivity or attenuation with the layer of precipitation computed on the basis of intensity. The computations are made using the mean relationships $Z - I$ and $\alpha - I$, determined by three methods: 1) Using all the material by the least squares method; 2) determination of the relationships for each rain, and then their averaging and 3) by the scanning method. It is demonstrated that the standard deviations of the parameters $Z - I$ and $\alpha - I$ of the relationships determine the accuracy in measuring the layer of precipitation during a rain. It was found that during measurements on the basis of reflectivity there can be a quite broad choice of parameters in the $Z - I$ relationship. The mean square relative error in measuring the precipitation layer is 25-30%. When measurements are made on the basis of attenuation this error is 10-15%. Bibliography of 8 items.
[11]

THERMAL REGIME OF OZONOSPHERE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 7, 1976, 7B161

[Abstract of article by R. S. Steblova, "Screening Effects in Heat Regime of the Ozonosphere"; Leningrad, TRUDY GLAVNOY GEOFIZICHESKOY OBSERVATORII, No 355, 1975, pp 23-41]

[Text] The absorption of direct solar radiation by ozone can be regarded as the principal source of the influx of radiant energy into the atmosphere below about 70 km; this is confirmed by estimates of the relative contribution of the absorbing components to the total quantity of absorbed radiation. The radiation arriving at a particular level is the residue of the energy not absorbed by the above-lying atmosphere. Taking into account the screening characteristics of the above-lying atmosphere, the author has computed the quantity of energy absorbed by ozone in the course of the daytime at altitudes 28, 24, 20, 16 and 12 km. The determined values correlate well with measurements of atmospheric temperature at these same altitudes. The peculiarities of the screening effect explain the presence of a low and even a frequently negative correlation between ozone density and the temperature, as is noted by many researchers. Bibliography of 19 items.
[11]

CHARACTERISTICS OF THREE-COMPONENT ACOUSTIC ANEMOMETER

Moscow IZVESTIYA AN SSSR, FIZIKA ATMOSFERY I OKEANA in Russian No 8, 1976, pp 880-885

[Article by V. Herstmann, H. Kaiser and G. Mucket, Potsdam Meteorological Observatory, GDR, "Investigation of the Angular Characteristics of a Three-Component Acoustic Anemometer"]

[Abstract] This paper is devoted to an experimental investigation of the angular characteristics of the acoustic anemometer produced by the Japanese firm Kaijo Denki. Specifically, a study was made of the influence exerted on measurement accuracy of the components of the stress tensor by deviations in the angular characteristics of the acoustic anemometer from cosinal when these deviations are not taken into account in the processing. The investigation was made by means of model computations, making use of three series of pseudorandom numbers (3,000 values) with stipulated cross-correlation coefficients. For analysis of a specific situation it is necessary to select the model parameters in accordance with real measurement conditions. For the purpose of increasing the accuracy of measurements with the acoustic anemometer it is possible to recommend use of approximations of the real angular characteristics and use them in computing the true components of each individual reading of the velocity vector.
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SOUNDING ELECTRIC FIELD OF HAIL-THUNDERSTORM CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B110

[Abstract of article by M. T. Abshayev, I. M. Imyanitov and Kh. M. Mashukov, "Apparatus for Sounding the Electric Field of Thunderstorm and Hail Clouds"; --, TRUDY VYSOKOGORN. GEOFIZ. IN-TA, No 31, 1976, pp 15-31]

[Text] The article examines the method and apparatus used for rocket sounding of the electric characteristics of thunderstorm and hail clouds designed for their investigation jointly with radar investigations: structure, dynamics and microstructure. The paper is accompanied by a block diagram and circuit diagram of the equipment employed for measuring three components of the electric field and the charge of the sounding equipment. It describes the telemetric channel for transmitting, receiving and registering the electric characteristics simultaneously with the space coordinates of the sounding equipment in the cloud and the temperature of the cloud medium. Also described is an apparatus for calibrating the measurement equipment. Tests under natural conditions indicated the good performance of the entire system, the satisfactory ballistics of the rocket with its apparatus, and made it possible to obtain preliminary results for the cloudless atmosphere which agree with data known in the literature. The proposed system makes it possible to carry out soundings of thunderstorm and hail clouds to altitudes of 7-8 km with a variable sounding rate. Information on the electric characteristics of a cloud can be tied in to the spatial structure of radio echoes and is related to the dynamics of development and microphysical characteristics of the investigated cloud obtained simultaneously using the two-wavelength MRL-5 radar, a three-wavelength experimental radar, Doppler radar and radar-radiometric apparatus. Bibliography of 14 items.
[11]

MEASUREMENTS IN THUNDERSTORM AND HAIL CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7B111

[Abstract of article by M. T. Abshayev, A. V. Belyavskiy, B. Kh. Tkhamokov and V. A. Vlaziyev, "Method and Apparatus for Doppler Measurements of Vertical Currents in Thunderstorm and Hail Clouds"; --, TRUDY VYSOKOGORN. GEOFIZ. IN-TA, No 31, 1976, pp 41-55]

[Text] On the basis of theoretical investigations of the correlation between the Doppler characteristics of meteorological radio echoes of hail and thunderstorm clouds and their microstructure, in particular, with the distribution parameters of particles by sizes, their concentrations and dielectric

properties (droplets, dry hailstones and water-encased hailstones, graupel), the authors have analyzed the merits and shortcomings of existing methods for the measurement of vertical currents (ω) in thunderstorm and hail clouds using Doppler radar. The authors propose new methods for measuring vertical currents and a block diagram of the apparatus for measuring them. The most universal method, suitable for investigations of hail and rain clouds of different microstructure, is the two-wavelength method, based on measurement of the mean Doppler frequency v_D and the ratio of the coefficient of attenuation of radar radiation at wavelengths 0.86-2.0 cm to radio reflectivity at wavelengths 10-30 cm ($K\lambda_i/\eta_{\pi\,i}$). In hail clouds it is possible to use a single-wavelength method based on measurement of the mean Doppler frequency v_D and the mean square width of the Doppler spectrum of frequencies σ_v in showers with a maximum size of drops greater than 2.4 mm; ω measurements can be carried out successfully using the upper boundary of the Doppler frequency spectrum f_{max}. The errors in all three methods do not exceed ±1 m/sec. The proposed design of the apparatus makes it possible to carry out measurements by all existing methods parallelly and ensures the possibility of their mutual comparison. Bibliography of 12 items.
[11]

III. OCEANOGRAPHY

News

OCEAN TEMPERATURE STUDIES DISCUSSED

Leningrad LENINGRADSKAYA PRAVDA in Russian 18 September 1976, p 4

[Interview with B. V. Novogrudskiy, "They Put a 'Thermometer' in the Ocean"]

[Text] In the office of B. Novogrudskiy, director of research on radiation temperature of the ocean, a specialist in the optical laboratory of the Leningrad Division of the Institute of Oceanology USSR Academy of Sciences imeni P. P. Shirshov, there are large maps showing the oceans of the planet. They show the regions where scientific ships have made and are making their investigations.

The expedition of the scientific research ship "Dmitriy Mendeleyev" lasted about three months. Specialists of the optical laboratory, in particular, studied the problem of remote measurement of ocean temperature.

"The ocean expanses have always attracted man," stated B. Novogrudskiy. "And today the ocean is becoming the object of ever-closer study. Its floor, for example, is capable of telling about the earth's past. An investigation of plankton, which absorbs carbon dioxide in enormous quantities and releases oxygen, will make it possible to understand the mechanisms of natural purification of the atmosphere. Climate and weather! They are in direct dependence on the state of the world ocean. After all, it absorbs an enormous quantity of solar energy and transmits it into the atmosphere in the form of latent energy, and then transmits it to the land. The ocean surface has a great inertia and holds the received heat for a long time. The most insignificant changes in its regime inevitably cause a response on the continents -- a hot or cold summer, for example. For example, the drought of 1972 is attributed by specialists to the fact that at this time a 200-m water layer in the North Atlantic was heated several degrees above the usual level.

Q: Boris Valer'yanovich, it becomes clear from what you have said that the ocean exerts an enormous effect on the processes transpiring on our planet. Evidently, without its study the preparation of long-range forecasts

is unthinkable?

A: One of the directions in optical investigations is preparation of a photographic portrait of the ocean, the use of satellites to determine its radiation temperature and the quantity of petroleum film on its surface, study of the distribution of plankton. The internal life of the ocean stands behind these purely factual data. This life is complex and diversified. If we find out its secrets, find a sort of key to the code which would provide information on a great many temperature characteristics, then we would be able, on the basis of the outward temperature relief, to determine at great depth the deep internal waves, currents, turbulent eddies and the characteristics of many other phenomena which at present it is impossible to 'read' in the information received from satellites. This matter is of very great importance for the national economy. A detachment of oceanic optics specialists under the direction of Candidate of Geographical Sciences E. N. Khalemskiy aboard the "Dmitriy Mendeleyev" was to continue its solution.

Q: What can you say about the results of the expedition?

A: A special complex of instruments aboard the ship registered not only the radiation temperature of the ocean, but also the factors forming it: water and air temperature, cloud cover. The automatic recorders plotted on paper the real picture of conditions. Scientists had to interpret these data in all their interrelationships.

During the expedition it was possible to clarify why there was a discrepancy between the readings of remote and contact measurement instruments. The fact is that during the time of the joint Soviet-American investigations of 1974, when aboard the scientific ship "Akademik Kurchatov" water temperature was measured by the usual method at the point where it had just been measured remotely by satellite, the data did not coincide. What was the reason for this? Specialists from Khalemskiy's detachment established that there are substantial temperature differences between the film of water which the satellite monitors and the deeper layer, where the temperature is registered by instruments on the ship.

The expedition of the scientific research ship "Dmitriy Mendeleyev" is of great scientific and national economic importance. Investigations of this type are bringing mankind closer to unravelling the secrets of the ocean.
[6]

Abstracts of Scientific Articles

ARSENIC AND ANTIMONY IN PACIFIC OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V167

[Abstract of article by A. I. Ryabinin and A. S. Romanov, "Arsenic and Antimony in the Equatorial Zone of the Pacific Ocean"; Sevastopol', MOR.GIDROFIZ. ISSLED., No 4(71), 1975, pp 192-203]

[Text] On the fourth voyage of the scientific research ship "Akademik Vernadskiy" in August-September 1971 the neutron activation method was used in investigating the distribution of As and Sb in the equatorial zone of the Pacific Ocean at 28 deep-water stations. This region is characterized not only by a poor degree of study of the geochemistry of As and Sb, but also by a complexity of the hydrological structure. On the basis of an analysis of more than 1,000 samples it was possible to construct diagrams of the distribution of arsenic salinity (KAs-S), antimony salinity (KSb-S) and arsenic-antimony coefficients. There was found to be a nonuniform distribution of As and Sb in both the horizontal and vertical directions, varying in the limits 0.2-25 and 0.08-3.6 μg/liter respectively with mean coefficients 4.2 and 0.6 μg/liter. The nondependence of the distribution of the two elements, despite their chemical anomaly, is explained by the combined effect of a number of factors: different sources of receipt, natural physical-chemical fractionation, different biological role. The pattern of isolines on the diagram made it possible to conclude that the KAs-S, KSb-S and KAs-Sb coefficients can be geochemical characteristics of water masses in the equatorial zone of the Pacific Ocean. Bibliography of 10 items. [11]

SURFACE AND INTERNAL WAVES OF ARBITRARY LENGTH

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 7, 1976, 7V121

[Abstract of article by N. P. Levkov and L. V. Cherkesov, "Boundary Layers of Surface and Internal Waves of Arbitrary Length"; Sevastopol', MOR. GIDROFIZ. ISSLED., No 4(71), 1975, pp 30-37]

[Text] A study was made of the characteristics of the velocity field arising in a two-layer fluid under the influence of the pressure stipulated at the free surface. The authors formulate the linear problem for a viscous nonrotating fluid of constant depth; in each layer its (constant) coefficients of horizontal and vertical exchange are stipulated. At the free surface pressure is non-zero on a segment and changes harmonically with time. At the boundaries of the layers the splicing conditions are stipulated, at the bottom -- the attachment condition, and at the free surface -- the pressure condition. The solution was found using integral transforms: it was analyzed distant from the region of generation of perturbations. The velocity field is analyzed in the subsurface and near-bottom boundary layers. A study was made of the influence of the viscosity coefficient and the frequency of pressure fluctuations. Bibliography of three items.
[11]

SHAPE OF PULSE FROM PNEUMATIC SOUND SOURCE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V52DEP

[Abstract of article by Ye. G. Popovich, Yu. P. Neprochnov, G. A. Semenov and I. N. Yel'nikov, "Shape of Pulse from Pneumatic Sound Sources of Great Power on the Basis of Experimental Data"; Moscow, FORMA IMPUL'SA OT PNEVMATICHESKIKH IZLUCHATELEY BOL'SHOY MOSHCHNOSTI PO EKSPERIMENTAL'NYM DANNYM, Institute of Oceanology, 1975, 12 pages (Manuscript deposited at the All-Union Institute of Scientific and Technical Information)]

[Text] The authors give an analysis of experimental data on the shape of the pulse from the PI-1 A pneumatic sound souce with chambers having a volume 1.5, 3, 7, 28 (4 x 7) liters for submergence depths of 10, 15, 20, 25, 30 m. The article gives the dependences of the amplitudes of the shock wave and pulsations, the period of the first pulsation and the duration of the pulse on chamber volume and depth of sound source submergence.
[11]

LIGHT FIELD STRUCTURE IN BOTTOM LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian, No 8, 1976, pp 834-840

[Article by A. P. Ivanov and V. G. Danilyuk, Physics Institute, Belorussian Academy of Sciences, "Light Field Structure in Bottom Layer of a Water Medium"]

[Abstract] Using model systems, the authors have experimentally studied the patterns of brightness and illumination in the bottom layer of a water basin. It is shown that in real water bodies there can be a transformation of the light field for all practical purposes only for the ascending radiation. It was possible to ascertain the extent of the layer in which the bottom exerts an influence on the photometric characteristics in dependence on the optical properties of the medium and the underlying surface.
[200]

DETECTION OF GAMMA-RADIATION DISTURBANCES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V57

[Abstract of article by I. F. Lukashin, "Rapid Detection of Disturbances of the Gamma Radiation Field"; Sevastopol', MOR. GIDROFIZ. ISSLED., No 4(71), 1975, pp 104-111]

[Text] In the study of variations in the activity of gamma radiation of sea water by counting instruments in situ the time required for measuring and identification of the spectrum is 30-60 minutes. For an accelerated determination of zones of variations of gamma fields the author proposes the integral registry of radiation in five energy ranges: soft range 0-300 keV, range of artificial radionuclides 300-900 keV, K^{40} range 1.2-1.6 MeV, range of radionuclides 1.6-3 MeV and hard range $>$ 3 MeV caused by the background of cosmic radiation. An acceleration of measurements is achieved by continuous registry of the soft range as constituting $>$ 70% of the scattered radiation and by a periodic comparison with a standard (once in one to five minutes). In the case of a positive response counting is triggered in the other four identification channels. Bibliography of five items.
[11]

MODELING OF SURFACE TURBULENCE IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian No 8, 1976, pp 841-849

[Article by G. I. Marchuk, V. P. Kochergin, V. I. Klimok and V. A. Sukhorukov, Computation Center, Siberian Department USSR Academy of Sciences, "Mathematical Modeling of Surface Turbulence in Ocean"]

[Abstract] The article describes a prognostic model of large-scale baroclinic circulations in the ocean. The coefficients of vertical turbulent exchange are found by solution of the equation of turbulent energy and

the equation of turbulent dissipation. The problem is solved numerically for the waters of the North Atlantic. There was found to be a surface turbulent layer whose depth varies from 15 to 120 m.
[200]

RECORD-MOVING MECHANISM FOR MAGNETIC RECORDING EQUIPMENT

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7V61

[Abstract of article by Yu. P. Grachev, "Economical Record-Moving Mechanism for Self-Contained Magnetic Recording Apparatus"; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 131-137]

[Text] The article gives an analysis of the operation and design of a record-moving mechanism (RMM) for precise magnetic recording. The RMM is designed for use in self-contained apparatus under conditions of restricted consumption of power and a prolonged registry time. A peculiarity of the RMM system is the use of an "isoelastic" drive. The author computes the tensions in different parts of the elastic belt (taking in both spool units and ensuring a tight winding of the tape on the receiving spool) and the magnetic tape. A study is made of the influence of the mechanism parameters on the speed of the magnetic tape. A numerical example of computations for the RMM is given. Bibliography of six items.
[11]

PROCESSING OF RADIO BUOY DATA IN DEEP SEISMIC SOUNDING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976 7D179DEP

[Abstract of article by G. N. Lunarskiy, I. N. Yel'nikov and A. A. Pokryshkin, "Experience in Automating the Processing of Radio Buoy Data in Deep Seismic Sounding"; Moscow OPYT AVTOMATIZATSII OBRABOTKI DANNYKH RADIOBUYEV PRI GLUBINNOM SEYSMICHESKOM ZONDIROVANII, Institute of Oceanology, 1976, 12 pages (Manuscript deposited at the All-Union Institute of Scientific and Technical Information)]

[Text] A study was made of the possibility of accelerated processing of seismic records on magnetic tape obtained in the course of work with seismic radio buoys and a pneumatic source of elastic oscillations with a large chamber volume. The magnetic records after appropriate processing are rerecorded with a discrete action recorder. This gives records of variable density in the form of travel-time curves which make it possible to ascertain the velocities of seismic waves.
[11]

ANALYSIS OF DATA FROM MARINE GRAVIMETRY BY OPTICAL METHOD

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7D243

[Abstract of article by V. A. Kuzivanov and O. A. Potapov, "Transformation and Analysis of Data from Marine Gravimetry Using Coherent Optical Systems"; Moscow, RAZVEDOCHNAYA GEOFIZIKA, No 70, "Nedra," 1976, pp 120-128]

[Text] On the basis of results of theoretical and experimental investigations the authors demonstrate the possibility of using coherent optical systems for the processing of data from gravimetric observations. The article gives some examples illustrating the use of optical filtering for the purpose of discriminating the regional and local field components, averaging graphs and studying noise, and also showing the effectiveness of spectral-correlation analysis of the initial observations.
[11]

IV. TERRESTRIAL GEOPHYSICS

News

GEOMAGNETIC PHENOMENA LINKED TO EARTHQUAKES

Leningrad LENINGRADSKAYA PRAVDA in Russian 9 September 1976, p 4

[Article by I. M. Pudovkin, "Hypotheses About Earthquakes"]

[Text] Recently the teletype has frequently brought alarming news: strong earthquakes have occurred in Japan, China, Italy, Turkey, Guatemala and in the Philippines... Thousands of persons have been killed and injured and hundreds of thousands have remained homeless. According to data in the GEOLOGICAL REVIEW, published in the United States, during eight months alone in this year there were 10 major earthquakes and three were of a gigantic intensity; this considerably exceeds the mean annual statistical data.

What has caused the increase in seismic activity on our planet? Our correspondent N. Nikitin asked Candidate of Physical and Mathematical Sciences I. M. Pudovkin, a senior scientific specialist in the Leningrad Division of the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, to answer this question.

"Scientists have several hypotheses explaining the appearance of earthquakes. It has been established that the mechanics of oscillations of the earth's crust, for example, is governed by different combinations of attractive forces in the interaction of the earth-moon-sun system. The intensity of the attraction deforming the earth changes and at definite moments attains its maximum. Fractures of the earth's crust occur in those places where the deforming forces exceed its strength."

"As a rule, these are mountainous regions which themselves are 'products' of movement of the earth's crust and continental drift. On the basis of such an assumption, professional seismologists have compiled maps of the earth's seismic activity; they cover many regions, including the Himalayan and Pacific Ocean zones, those where the occurrence of earthquakes is most probable. But without taking into account the internal

processes transpiring in the depth of our planet it is impossible to guess the time and place of their occurrence. Therefore, scientists are now engaged in a search for and study of considerably more precise, symptomatic phenomena accompanying earthquakes."

"The magnetologists actively concerned with the problem of their prediction have their own hypothesis. The climatic and natural anomalies which we are now observing can be caused by the drift of a solid subcore, a reflection of which is the drift of the magnetic center of the earth. Beyond the solid envelope of our planet with a thickness of approximately 3,000 kilometers there is a liquid core in which a gigantic mass with a radius of more than a thousand kilometers -- the solid subcore -- floats."

"It floats in a closed elliptical curve, tilted to the equatorial plane at an angle of 32°. This movement can lead to an increase in deforming forces. It is logical to assume that at the times of maximum approach of the subcore to the solid envelope of our earth in the neighborhood of the Himalayas there will be an increase in seismic activity. A confirmation of this is the recent major earthquakes in China, in the Philippines, at Gazli. These calamities occurred precisely at the epicenter of possible drift of the subcore."

"At the present time the earth's magnetic field is the most universal means for solving the problem of predicting earthquakes. A scrupulous investigation of the processes transpiring in this enormous natural laboratory will assist scientists in making a precise diagnosis of the state of the space within the earth."

"The first practical steps on the way to unravelling the deep secrets of our planet have already been taken. Soviet scientists, generalizing data from observations of rapidly transpiring variations of the magnetic field in the Alma-Ata geophysical polygon in Kazakhstan, in Central Asia and other regions of the country, have obtained a basis for brief (from two to eight hours) prediction of earthquakes."

"But now many scientists working in this field have concluded that for successful solution of the problem it is necessary to have broad coordination of the activity of seismologists, magnetologists and geophysicists of different countries. A preliminary program of joint investigations of the earth's force fields was formulated during the past year at the Sixteenth General Assembly of the International Union of Geodesy and Geophysics at Grenoble.
[22]

ARTICLES ON METHODS IN GEOPHYSICAL OBSERVATIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7D103K

[Abstract of collection of articles VOPROSY OBRABOTKI I INTERPRETATSII GEOFIZICHESKIKH NABLYUDENIY. SB. STATEY, No 13, UCH. ZAP. PERM. UN-TA, No 357, Perm', 1975, 183 pages]

[Text] This collection of articles contains papers on different methodological problems in geophysical prospecting. With respect to seismic prospecting the papers examine the problems involved in the theory and practice of the general deep point method and the vertical seismic profiling method, study of anisotropic media, investigation of the properties and use of different dynamic parameters in the processing and geological interpretation of seismic data. With respect to gravimetric prospecting the papers consider the matters of a model of local structure, transformation of a three-dimensional axially symmetric field into a two-dimensional field, highly accurate computation of normal gravity values, equivalence of different offsets, null-point shifts, etc. With respect to electric prospecting the papers examine a number of problems related to the interpretation of vertical electric soundings, and with respect to magnetic prospecting -- the problem of determining the depth of the lower boundary of a body, etc. In addition, communications of a debatable nature are given on different subjects.
[11]

Abstracts of Scientific Articles

STAND FOR TESTING GRAVIMETRIC INSTRUMENTS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7G261P

[Abstract of patent awarded to Yu. V. Bobrov, V. A. Gladun, V. L. Panteleyev, Ye. G. Voropayev and I. N. Kaptsova, Moscow University; Moscow, Author's Certificate No 444149 (No 1725193), published 7 May 1975]

[Text] The stand contains moving horizontal and vertical platform, motor, reducer, crankgear and mounting platform. On one of the platforms there is also a motor and reducer with a horizontal shaft on which is mounted an eccentric supporting one end of the mounting platform. The other end is connected to the moving platform by means of a knife support. [11]

RATE OF FRACTURING AT EARTHQUAKE FOCUS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 8, 1976, pp 16-30

[Article by A. V. Vvedenskaya, Institute of Physics of the Earth, "Rate of Fracturing at an Earthquake Focus and the Form of Seismograms of Body Waves"]

[Abstract] The paper cited above is a further development of earlier publications by the author on investigation of the characteristics of a wave field excited by a source in the form of an expanding slippage area. The author has investigated the peculiarities of theoretical seismograms associated with the variable rate of fracturing at the source. The results show that the form of the theoretical seismograms is determined by the form of the fracturing rate function. Continuous fracturing over a limited time with any peculiarities of the process rate function at the source cannot cause a sign-variable train of impulses characteristic for the seismograms of earthquakes. A correspondence between the theoretical and real seismograms is possible in the case of interrupted fracturing when the rate of the

process for some time interval becomes equal to zero. The theoretical and real seismograms were compared. The conditions for their correlation are discussed.
[186]

EVALUATION OF NONUNIFORMITY OF EARTH'S ROTATION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 7, 1976, 7A14

[Abstract of article by Yu. A. Bilde, "Evaluation of Nonuniformity of the Earth's Rotation Caused by Magnetic Disturbances on the Sun"; --, ASTROMETRIYA I ASTROFIZIKA. RESP. MEZHVED. SB., No 28, 1976, pp 14-21

[Text] Within the framework of a simple model the author gives an evaluation of the nonuniformity of the earth's rotation caused by magnetic disturbances on the sun in circumterrestrial space. The article examines the case of periodic and aperiodic disturbances. The model used includes the following assumptions: 1) the earth is assumed to be an absolutely solid spherical top with a constant moment of inertia; 2) the geomagnetic field is assumed to be a dipole with a centered point dipolar magnetic moment rigidly coupled to the earth's body; 3) the evolution of the geomagnetic field and the influence exerted on it by magnetic disturbances are not taken into account.
[11]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

NOTES ON BIOLOGICAL EXPERIMENTS ON "SOYUZ-22"

Moscow IZVESTIYA in Russian 18 September 1976, p 5

[Article by B. Konovalov, "The Biology of Weightlessness"]

[Excerpt] Candidate of Biological Sciences G. Nechitaylo said to us: "To a great extent the biological investigations which were carried out under the 'Soyuz-Apollo' program are being continued aboard the 'Soyuz-22'. This is attributable to the need for orderliness in carrying out research and the need for accumulating statistical material."

At the wish of scientists, V. Bykovskiy and V. Aksenov have become the keepers of many terrestrial creatures which are kept in different containers of the biological instruments. The cosmonauts were given an ampule filled with microorganisms which will grow in a snakelike tube which is similar to a labyrinth. As they grow, this tube, filled with a nutrient medium, will be transformed from light yellow to dark violet. As a result of this graphic change in color the cosmonauts will be able to trace the rate of development of the microorganisms under weightlessness conditions.

In a second unit of the instrument, which has been given the name "Biokat," where all three biological containers are at a constant temperature, the cosmonauts have started a genetic experiment. They have moistened the seeds of Crepis, which more than once have been in space, and these have begun to germinate. Prior to ending of the flight their development will seemingly be "frozen" and scientists, using the great arsenal of research methods and tools, will be able to trace all the changes in the genetic apparatus. The third "Biokat" capsule contains the eggs of aquarium fish. Scientists are interested in how the organs of fish sensing gravitation develop under weightlessness conditions.

All the biological experiments are being duplicated in ground laboratories so that it will be possible to compare weightlessness conditions with terrestrial conditions. In one of the experiments scientists will try

to explain whether there is a difference in the biological rhythm of life under weightlessness conditions and on the earth. An instrument which is known as the "IFS-2" holds the duckweed turion, the same that fills overgrown ponds. Turions are a special form of this plant when under unfavorable conditions it falls into a state of "hibernation." Crushing the ampules on the first, second, third and last days of the flight, the cosmonauts introduce to the turions special physiologically active substances which arouse them from their hibernation. After the end of the flight the scientists will be able to compare the state of the plants which have lived for different times under weightlessness conditions with their "colleagues" on earth.

The comparison method is also used in the "Biogravistat" experiment which is being carried out for the first time in space. The experiments aboard the Soviet "Salyut" orbital stations with prototypes of future greenhouses indicated that during the prolonged development of plants weightlessness exerts an unfavorable effect. Therefore it was decided to check whether or not a favorable influence would be exerted by at least a small artificial gravity such as arises aboard the ship during the firing of the engines, during the orientation of the ship on the sun. Corn seeds are wetted by the cosmonauts in two spherical containers. One of them is rigidly coupled to the body of the ship, whereas the second is suspended on special springs which soften the influence of brief accelerations. The presence of accelerations is registered by a special instrument during the course of the entire flight. The control container is kept under ordinary terrestrial conditions. The results of this and other biological experiments will be learned when the "Soyuz-22" returns to the earth.
[233]

NOTES ON START OF "SOYUZ-22" FLIGHT

Moscow PRAVDA in Russian 16 September 1976, p 1

[Article by A. Pokrovskiy, "Thus the Orbit is Formed"]

[Text] Here at the Flight Control Center near Moscow we have seen and heard clearly everything which had occurred at Baykonur during the period of preparations for launching of the "Soyuz-22" and its entry into orbit. But the direction of these operations was accomplished there at the cosmodrome. However, already after a few minutes we heard through the loudspeaker:

"The ship commander has established communication with the Flight Control Center."

Beginning with that second all the flight control lines of communication were concentrated in the Moscow area. In the main hall at the center the representatives of the numerous services undertook the space watch.

In the breaks between communication sessions we met with some of them and asked them to share their first impressions.

A. V. Filipchenko, USSR flier-cosmonaut, twice Hero of the Soviet Union, stated that it was easy to work with the crew; it was easy to sense the excellent preparations which Valeriy Bykovskiy and Vladimir Aksenov had made for flight.

"Their feeling of well-being is excellent and they are in a working, high-spirited mood. They are carrying out all operations in the initial flight stage with a knowledge of what they are doing and with enthusiasm."

We asked V. Sevast'yanov, USSR flier-cosmonaut, twice Hero of the Soviet Union, to comment on the crew's actions during the first revolutions.

"First of all, I would like to recall," stated V. Sevast'yanov, "that under the 'Apollo-Soyuz' program preparations were made for the flight of two 'Soyuz' ships. And now the reserve ship is being used in carrying out an experiment prepared by specialists of the USSR and GDR."

The "Hawks" [Yastreby] first of all must demothball the equipment and check the operation of all the ship's system. In addition to this, V. Bykovskiy and V. Aksenov must carry out, as we have already mentioned, a correction of its orbit. Recently this has been done in order to obtain the possibility of docking the ship with an orbital station. Now the purpose of the next is to form the orbit in such a way that the "Soyuz-22" will pass over regions of the earth's surface intended for surveys at the most favorable times. Indeed, for the MKF-6, as for any camera, the conditions of illumination of the surveyed objects are important. This was already taken into account when putting the "Soyuz-22" into orbit. Nevertheless, the orbit requires some refinements.

These operations for refining the orbit are being carried out by the center and the cosmonauts in close collaboration. On the earth specialists are refining the orbital parameters, computing the time and intensity of the impulses. These data are being transmitted to the crew and it is being guided by them in its actions.

Thus, the day-to-day work in space and on earth has begun.
[212]

"ROST" EXPERIMENT ABOARD "SOYUZ-22" DESCRIBED

Moscow PRAVDA in Russian 19 September 1976, p 6

[Article by A. Pokrovskiy, "Spectrum of Experiments"]

[Excerpt] Aboard the "Soyuz-22," in addition to a multispectral photographic survey of the earth's surface, a broad spectrum of experiments is being carried out. In addition to surveys of the earth, moon and the earth's horizon, cosmonauts are carrying out medical and technical investigations and are devoting much attention to biological experiments.

How precisely they have been thought out and what important results are expected for science is indicated, in particular, by the experiment which has been given the code name "Rost" ["Growth"]. We were told about it by Doctor of Biological Sciences V. A. Kordyum, division head at the Institute of Molecular Biology and Genetics of the Ukrainian Academy of Sciences.

"Outwardly all the operations for carrying it out look simple. A special biothermostat holds a 50-gram insert with a nutrient medium. On the first day of the flight V. Bykovskiy and V. Aksenov introduced there the bacillus Proteus vulgaris which was in a state of deep anabiosis. Being in the nutrient medium, the bacteria begin to move and multiply. Under the influence of their vital functions the medium changes its color and twice a day the cosmonauts measure how much the front of bacterial growth has moved. The experiment is designed in such a way that the Proteus gradually again enters into anabiosis. This means that one could be sure that its active vital functioning transpired only under space conditions."

"But despite this simplicity there is a possibility of deep investigations of changes in cell structure and genetic restructurings." Vitaliy Arnol'dovich recalled that this same experiment was carried out during the joint flight of the "Soyuz" and "Apollo." At the Institute of Molecular Biology and Genetics and at the Botany Institute Ukrainian Academy of Sciences the collected material was analyzed with respect to 20 indices. And about half of them indicated deviations from development under terrestrial conditions. Now studies are being made to ascertain the mechanism of these biological changes and to ascertain their reasons.

"In order that you can visualize how precise are the complex investigations of 'cosmic' Proteus, I would like to tell about how this work is done at the Botany Institute," says V. A. Kordyum. "We isolate for investigation approximately 1/2 a millimeter of material from each sample. The collected mass is concentrated and then we make ultrathin sections. They are tagged in a special way so that after analysis of each section the cell can be reconstructed. This will make possible a deeper study of cell microstructure, in which the influence of space conditions is expressed with particular clarity. It goes without saying that this work will require more than a little time. A number of laboratories at our two institutes will work for several months on those few millimeters of material which are being returned to earth by V. Bykovskiy and V. Aksenov."

All this is hidden behind the brief sentence: "The cosmonauts have carried out the next experiment."
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POST-FLIGHT MEDICAL STUDIES OF "SALYUT-5" COSMONAUTS

Moscow IZVESTIYA in Russian 28 August 1976, p 2

[Article by V. Konovalov, "On Earth After Weightlessness"]

[Text] From the first day of presence aboard the orbital station the cosmonauts have begun preparations for their subsequent return to earth -- from weightlessness to terrestrial gravity. Everyone already knows that readaptation to the earth after being separated from it for a long time is no less difficult than adaptation to weightlessness. Therefore, from the first to the last days of the flight the cosmonauts train their bodies and do not allow their muscles to weaken. They wear special load suits and for not less than two hours a day engage in complex physical training: they walk, run and do chin-ups.

The thorough medical examinations which are carried out in flight pursue two principal goals: ascertaining the influence of flight conditions on the human body and its different systems and predicting the condition of the cosmonauts during the remaining part of the program and after return to the earth.

In addition to the routine monitoring of the state of the "Salyut-5" crew, the physicians approximately once a week carried out a detailed medical examination of B. Volynov and V. Zolobov. Particular attention was devoted to the cardiovascular system, which reacts most acutely to spaceflight conditions. Under weightlessness conditions, where there is no customary pressure from below created by terrestrial gravitation, the blood pours toward the upper half of the body and is seemingly retained there.

The detailed investigations, including of cerebral circulation, carried out on this flight once again demonstrated that more than usual blood fills the head, lungs and liver. The organism manifests instinctive wisdom, thinking out in advance that it is necessary to return to terrestrial conditions. Then the blood again rushes downward and it is necessary to create some "reserve" so that thereby the circulatory system will be filled. Otherwise the well-expressed blood outflow from the head can cause fainting.

Candidate of Medical Sciences Vladimir Aleksandrovich Degtyarev tells us: "Knowing this, the cosmonauts are preparing in advance for their meeting with the earth. Prior to landing they drink more than usual in order to increase the volume of fluid circulating in the body and underneath the spacesuit they put on special prophylactic suits which create increased

pressure on the surface of the legs and the lower part of the torso and hinder the outflow of blood. On the basis of data from the flight medical investigations we predicted what the condition of the cosmonauts would be after return to the earth. This prediction proved to be correct. They experienced the encounter with terrestrial gravity very satisfactorily. Now adequate material on prolonged space flights has already been accumulated and it will give a basis for optimistic evaluations of increasing flight duration. Objective analytical data indicate that after the adaptation period, when there is a complex process of restructuring and adjustment to new conditions, the state of the cosmonauts reaches a plateau and no marked changes are observed. It should be noted that against the background of common regularities there is also clear manifestation of individual peculiarities of different persons. For example, in all there is a rush of blood to the head, but each senses this differently. Thus, Sevast'yanov noted a rush of blood, whereas Klimuk seemingly did not feel it."

In Volynov and Zholobov, as we ourselves can see these days, the adaptation process is transpiring successfully. They are already taking strolls through the park, are walking to the river, taking delight in greenness. It can be seen that these simple terrestrial pleasures afford them great joy. Their appetite is excellent. They sleep well. To be sure, for the time being it is without pillows so that there will be a slight flow of blood to the head to which they had been accustomed in space.

Immediately after return to the earth they walked like sailors after a long voyage, wavering slightly and putting their legs far apart. Now their gait has become usual. They joke and laugh a lot. Seeing the newspapermen, Volynov reels a little on purpose.

"What's up?"

"The physicians have analyzed it," he laughs.

"Now we are carrying out investigations along two lines," Candidate of Medical Sciences Arkadiy Vasil'yevich tells us. "This includes a very thorough investigation of individual body systems and an examination under a unified program, employing the same instruments and the same methods as were used before the flight and during its course. This will make it possible to detect those changes which are brought about by the flight itself."

Aboard the "Salyut-5" the cosmonauts for the first time have carried out a medical examination immediately after sleep. This is very interesting for us because it will afford a possibility for separating the pure influence of weightlessness from that which is imposed by a whole day of work in orbit. Now it is necessary to think of setting norms for the workday of cosmonauts during prolonged flights and objectively evaluate their performance. This is important for future flights.

The condition of Volynov and Zholobov, according to the data from medical examinations which have been carried out, is entirely normal. We think that after several days we will be on a flight to Moscow.
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NOTES ON BACKGROUNDS OF "SOYUZ-22" COSMONAUTS

Moscow PRAVDA in Russian 16 September 1976, p 2

[Article by V. Gubarev, "Our Work is to Dream!"]

[Excerpts] V. Aksenov: Bykovskiy is from the legendary first detachment of cosmonauts. On 14 June 1963 he went into orbit on the "Vostok-5." Then his companion was "Chayka" -- Valentina Tereshkova. A group flight of two ships was completed on 19 June. Valeriy was the first to be launched and the last to land. One of the western newspapers then called him a "space gentleman." Four times Valeriy freely floated in the ship cabin. He was present in space for five days; that was a record for those flight years. Bykovskiy worked in orbit for a total of 119 hours 6 minutes.

V. Bykovskiy: Vladimir had nine hours of weightlessness to his credit. This is a great deal for terrestrial conditions. Aksenov made more than 250 aircraft flights in preparing space crews for a launching... However, it is probably necessary to tell about things in order. Beginning in 1964, on the initiative of S. P. Korolev, specialists of the design bureau have been participating in the checking of ship systems, testing methods for man's work aboard a spaceship. Beginning in 1966 Aksenov participated in all the tests related to weightlessness...

V. Aksenov: Incidentally, together with Valeriy I prepared Yeliseyev and Khrunov for transfer from ship to ship in open space.

V. Bykovskiy: We are suited to one another. Vladimir is patient, calm and never hurries. During training we have "played through" all possible so-called "nonstandard situations." The ship's engineer easily determined their reasons. He knows the ship to the last detail. Beginning with the "Voskhod-2" when Leonov and Belyayev flew, Vladimir has participated in flight control.

V. Aksenov: One can envy the work performance of Bykovskiy. He has thoroughly studied all types of ships. He has prepared many space programs. In addition, Valeriy has carried out scientific work. His Candidate's dissertation was devoted to navigation in space.
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FINAL PHOTO OPERATIONS ON "SOYUZ-22"

Moscow IZVESTIYA in Russian 23 September 1976, p 5

[Article by B. Konovalov, "The Finish Draws Near"]

[Text] On the 98th revolution of the "Soyuz-22" the ship should pass over our flight control center near Moscow.

"The weather is excellent, visibility is excellent," says V. Aksenov, who had just photographed Kiev from space.

"'Yastreby,' at $13^h41^m35^s$ you will pass Zvezdnyy," reports "Zarya" joyfully.

"Through the window you do not now see anything special," says V. Bykovskiy, busy at ship control, "but the 'Raduga' is nevertheless at work."

Using the "MKF-6" photographic system the cosmonauts have surveyed Kiev and Moscow so that scientists will be able to check the state of the air basin over these large cities.

On the next revolution the territory of the German Democratic Republic was photographed. This was the last opportunity for obtaining good photographs. Unfortunately, a well-developed cyclone hovering over Central Europe covered the territory of our fraternal republic with a mass of clouds. Nevertheless, it was decided to carry out the planned survey in order, at least, to photograph some regions through breaks in the clouds.

Simultaneously with the "Soyuz-22" an aircraft laboratory of the Space Research Institute USSR Academy of Sciences operated over the GDR. It was outfitted with the same "MKF-6" apparatus. This aircraft flew to the GDR on the morning of 20 September after synchronously with the "Soyuz-22" making a survey of irrigated agriculture in the Fergana valley. A group of Soviet specialists arrived aboard the aircraft; they will carry out ground investigations using a portable field spectrometer.

"On 20 September a Soviet An-30 aircraft laboratory, working along the 'Soyuz-22' flight trajectory, took 500 photographs," stated the director of the Electronics Institute Academy of Sciences GDR H. Fischer, who heads a group of GDR specialists who these days are working at the Flight Control Center and at the Space Research Institute USSR Academy of Sciences. "We are very happy that on the last day of the survey, 21 September, the weather over us became better. There were relatively few clouds and evidently we will obtain fairly good photographs. Scientists are awaiting them with impatience. We have formulated a major program for the use of these photographs for scientific and practical purposes."

"But, to be sure, the greatest joy was afforded us by the excellent operation of the 'MKF-6' photographic system, created at the people's enterprise 'Karl Zeiss Jena.' In one of the rooms at the Space Research Institute USSR Academy of Sciences there is a 'twin' of the on-board equipment. And if by chance on the 'Soyuz-22' there are any malfunctions, our specialists will be able to 'play through' the developing situation and give advice to the cosmonauts on how to solve the problem. But they played the role of happy unemployed. The 'MKF-6' photographic system operated faultlessly."

The survey in space was completed on 21 September. In the evening the cosmonauts unloaded the camera and put the film into capsules which will return to earth with them. The Space Research Institute USSR Academy of Sciences and other interested organizations are ready to process the collected information. Specialists at the Space Research Institute, in collaboration with organizations in the GDR, have created a complex for processing the space photographs. The basis for this is high-capacity "EC-1040" equipment which was furnished by the GDR people's enterprise "Robotron."

Processing data are printed on each frame taken with the "MKF-6" system: survey time, number of film and photograph number. And what is most important -- ten circles of a definite standard brightness. By later comparing the degree of blackening of any detail on the photograph with these circles it is possible to determine the absolute brightness of all the natural features, prepare a catalogue of them and organize automated processing of the photographs. Even now the machines will be used in order to suggest to researchers from what six regions it is necessary to take four combinations of frames in order by use of artificial color to discriminate the features of interest to them, for example, the shelf zone of the seas, deciduous forests or fields with sprouting winter crops.

Soon the machines will be in operation. On the morning of 22 September the cosmonauts carried out a general rehearsal of the impending landing and checked out the operation of the braking engine and all on-board automatic systems. The finish of the flight is approaching.
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EXAMINATION OF LUNAR SOIL DESCRIBED

Moscow IZVESTIYA in Russian 26 August 1976, p 5

[Article by A. Ivakhnov, "A Particle of Our Satellite"]

[Text] "I have just seen lunar ground with my own eyes!"

Vasiliy Vysochkin, an "earthling," who had extracted a container with lunar ground from the return vehicle of the "Luna-24," told me that this did not excite him very much. After all, this is the third, after the "Luna-16" and "Luna-20," time he had done such a thing. But it is difficult to

believe him. Is it possible to be calm when you have in your hands particles of a different celestial body?

On the evening of 24 August, on the invitation of Professor Yu. Surkov, I arrived at the Institute of Geochemistry and Analytical Chemistry imeni Vernadskiy USSR Academy of Sciences. Yuriy Aleksandrovich led me into a laboratory in the midst of which stood a vacuum chamber which was specially constructed for the reception of lunar samples. It is a horizontally arranged metal cylinder with round windows -- they are on the sides, on the top and in the ends.

In order for the samples of lunar ground not to be subjected to the influence of our terrestrial gases, the air was evacuated from the chamber to a pressure of billionths of an atmosphere and then it was filled with an inert gas -- helium. By means of a special knife the top of the return vehicle ampule was cut in a circle. And now, finally, a hand in a rubber glove extracts from the ampule a long drum with a spiral furrow in which sits the ground carrier -- a tube of a golden color with a length of about two meters and as thick as a finger, filled with that substance for which the expedition of the interplanetary robot geologist was outfitted. Senior scientific worker A. Ivanov slowly unwinds the tube with the precious load from the drum and centimeter after centimeter lays it on the so-called "snail" -- an apparatus somewhat resembling an electric stove, and the ground carrier fits in it like a heating spring.

In one of the ends of this chamber there is a lock for extracting different unnecessary objects or, vice versa, placing necessary objects within it. Before the hatch connecting the lock and the chamber is opened, the air in it is also replaced by helium. A container with a sensitive film is put in the lock: now an x-ray photograph of the samples returned to the earth will be taken.

Yu. Surkov states: "Along the length of the tube the ground is distributed in layers with different structure. Each layer is a trace of some stage in the history of the moon, or at least, that part of the Mare Crisium where the drilling was carried out. Using the x-ray photograph we will determine in what places we must cut the ground carrier in order not to mix samples from different layers."

Finally the photograph is ready. A commission of scientists adopts a decision about opening the ground carrier. One of the operators puts his hands into rubber gloves and carefully takes scissors similar to those used by a surgeon. The first ground particles from the lunar Mare Crisium were strewn into a tiny furrow of the "snail" from the cut ground carrier tube. These included dust particles and tiny pebbles and slag particles.

Yu. Surkov says: "It is interesting that the 'Luna-16' ground was dark brown with a luster characteristic for a large number of fused particles. The 'Luna-20' brought completely different samples -- there was

less luster and the color was lighter -- ashen. In both cases there were very few particles with a diameter of several millimeters. Here, however, the particles were of the most different size, some even more than half a centimeter."

I ask the scientist to evaluate the preliminary results of the experiment.

"It is too early to speak about the results, but even now it can be said that the flight was successful and the drilling was very effective. I do not doubt that study of this ground will enable us to interpret the history of formation of the Mare Crisium and the entire mountainous region adjoining it."
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READAPTATION STUDIES OF "SALYUT-5" COSMONAUTS

Moscow PRAVDA in Russian 29 August 1976, p 3

[Article by N. Zheleznov, "The Cosmonauts at Baykonur"]

[Text] It is already the third day in a row that we have arrived in the morning at the "Kosmonavt" hotel and we ask one and the same question: "How does the crew feel?"

"Nothing unexpected or sensational," respond the physicians on duty, "everything is developing as we surmised according to our predictions.

The descent module of the "Soyuz-21" has already been delivered from its landing site to Moscow, the work halls of the "Salyut-5" flight control center have been abandoned, but at the medical headquarters for this flight, which after the landing moved to the Baykonur cosmodrome, the program is still continuing. We discussed the problem "Man in Space" with the director of medical preparation of cosmonauts, A. V. Yeremin, and a specialist in the field of space medicine, V. A. Degtyarev.

"The tactics for adaptation of the cosmonauts and their activity under weightlessness conditions," states V. A. Degtyarev, "has already been checked out quite well. What is its basic idea? The absence in a state of weightlessness of any terrestrial loads on the muscles and cardiovascular system requires mandatory compensation which is achieved by means of physical exercises and also by the wearing of special load suits."

Now the method for "putting the body into a state of weightlessness" has already been clearly worked out and tested, in particular, once again in the course of the seven weeks of work by Boris Volynov and Vitaliy Zholobov aboard the "Salyut-5." The special load suit which is constantly

worn by the cosmonauts, in combination with the system of complex physical exercises, all this has guaranteed the crew a virtually safe encounter with terrestrial accelerations during landing and on the first days spent on the earth.

"In the same clear sequence as putting the body into weightlessness, but in the reverse order, we accomplish a return of the bodies of the cosmonauts to the earth," states A. V. Yeremin. "On the basis of the experience of preceding prolonged expeditions with the 'Salyuts' we understood that physical exercises alone are not enough for maintaining the tone of muscles and the cardiovascular system customary for earth. It was proposed that not long before the landing the cosmonauts increase the volume of their training."

"Now that the medical laboratory has 'descended to earth'," states A. V. Yeremin, "the cosmonauts are also very conscientiously assisting us. They cannot to any degree be called the 'objects' of our investigations; they themselves are researchers, active, knowing their business."

"The desire to walk a little more is the only thing about which the cosmonauts and physicians are not in full agreement these days. In the acute period of readaptation, which lasts up to five-seven days, the most dangerous enemy is haste," states A. V. Yeremin. "Now, when each cell in accordance with its own program, is still 'returning to the earth,' heavy loads are undesirable."

When we were ending the conversation the heroes appeared on the avenue.

"Well there, doctor, can I already go a hundred meters?" asks Vitaliy Zholobov, smiling.

"Only in the tempo of a sport walk," responds the doctor with a joke in response to the joke.

"Well, thanks," interrupted the ship's engineer and he strode down the avenue.
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NOTES ON FLIGHT OF "SOYUZ-22"

Moscow IZVESTIYA in Russian 19 September 1976, p 1

[Article by B. Konovalov, "Earth in the Lenses"]

[Text] On the large map of the world in the main hall at the Control Center, where the sinusoidal projection of the orbit of motion of the "Soyuz-22" shows up as a bright point, small circles denote the zones of radio-visibility of the ground tracking stations and ships of the USSR Academy of Sciences "Akademik Sergey Korolev" and "Kosmonavt Yuriy Gagarin." The latter is occupying a traditional site along the shores of the Canadian Sable Island. But now the "Akademik Sergey Korolev" instead of its usual place along the shores of Cuba has moved to the shores of Iceland in order to lengthen the communication time between the Control Center and the spaceship.

The orbital plane in which the ship flies in space virtually does not change. It only moves together with the earth in the age-long orbit of our planet around the sun. And the earth, in rotating about its own axis over the course of 24 hours, "freely" turns a panorama of the earth's surface in front of the objectives of the "Soyuz-22" camera. At a latitude of 50°, passing approximately through the center of our country, during each revolution of the satellite the earth moves westward by approximately 1,600 km for the ship, so that from aboard it new territories can be seen all the time. After 24 hours the ship passes this same 50° latitude to the west by approximately the width of the zone covered by the field of view of the camera from space, so that during the flight it is possible to cover virtually the entire territory of the country under favorable conditions.

At the press conference which was held on 17 September at the Space Research Institute USSR Academy of Sciences many expressed interest in when a survey of the territory of the socialist countries would be made. Unfortunately, a well-developed cyclone now prevails over Europe, accompanied by dense clouds. This has hindered the planned survey of the territory of Hungary and Czechoslovakia. But the weather did favor a survey of the expanses of our country.

The unique "MKF-6" camera, constructed in the GDR, with all its six objectives simultaneously prints on each frame a strip of the earth's surface with a width of approximately 165 km and a length of 110 km. This is an enormous area. Accordingly, on 17 September V. Bykovskiy and V. Aksenov succeeded in surveying the territory of the Far East, the shelf zone of the Sea of Okhotsk and regions adjacent to Magadan. On the next revolution -- the regions of the Baykal-Amur railroad, near Ulan-Ude, Chita and Yakutia. On the 32d revolution -- the mountains surrounding Issyk-Kul', the Altay and Central Siberia. Then a survey was made of the European territory of the union. And all this during one day of work in orbit!

A distinguishing peculiarity of the survey with the "MKF-6" camera is the allowance made for the enormous velocity of the ship. After all, during the time of an exposure the "Soyuz-22" on the average covers a distance of a half-kilometer. In such cases each point on the film can be

transformed into a line and the entire image is blurred. In order for this not to happen and for the photographs to be clear a special unit in the apparatus changes the inclination of the axis of objects during movement in the survey so that one and the same territory is in the field of view during the time of the exposure. Then the field of view of the camera seemingly "skips" to another area and the next frame is taken.

The leader of the press conference, the director of the Space Research Institute USSR Academy of Sciences, Academician R. Sagdeyev, in answering the questions of journalists, noted that aboard future orbital stations, where in accordance with an agreement already reached, international crews will begin to work, including cosmonauts of the socialist countries, the program for investigation of natural resources from space will undoubtedly occupy an important place.

Another experiment which is of extremely great importance for the future of cosmonautics is proceeding simultaneously. On 19 September the "Salyut-4" station will make its 10,000th revolution over the planet. All its systems have been operating normally for more than 1 1/2 years. During this time the cosmonauts A. Gubarev and G. Grechko worked aboard it for a month, P. Klimuk and V. Sevast'yanov worked aboard it for two months, and for three months it was docked to the unmanned ship "Soyuz-20." Now resource tests of technical systems are continuing; in the future they will make it possible to create stations which are capable of operating in space for years.
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COSMONAUTS COMMENT ON THEIR OBSERVATIONS

Moscow PRAVDA in Russian 25 August 1976, p 3

[Article by A. Pokrovskiy, "Thank You for Your Work"]

[Excerpt] In the break between saturated communication sessions we asked USSR Flier-Cosmonaut Yu. P. Artyukhov to summarize the first preliminary results of the space flight of the "Baykaly." He noted that Boris Volynov and Vitaliy Zholobov formed a sort of "space affiliate" of several institutes of the USSR Academy of Sciences all at once -- physics, crystallography, general genetics and other scientific institutes. They also acted as personnel of an experimental enterprise mastering for future space production the technology of producing materials with such properties as are unobtainable on earth. And they have also worked on solving a number of problems whose solution is called for by the Tenth Five Year Plan for development of the national economy of our country. For example, surveys of the territory of the USSR made from aboard the "Salyut-5" will assist geologists and mineral prospectors, land improvement workers in the exploitation of new lands and geographers in the multisided investigation

of the region adjacent to the eastern part of the Baykal-Amur rail line.

Yuriy Petrovich concludes: "Even from a fleeting enumeration of the work done by the 'Baykaly' it can be seen with what great dedication they have worked in orbit. Their work deserves high marks."

It is interesting to compare this brief commentary with that which was given earlier to newspapermen by "Salyut-5" crew members during the last radio interview held before landing:

"The flight is going well; everything here is in order. It goes without saying that by the end of the workday we are tired, especially since 1 1/2 months of flight are already behind us. But, upon awakening in the morning, we feel rested and with joy proceed to a continuation of the program. And I say with joy because we know that we are working in the name of the Motherland, in the interests of the Soviet people and our national economy."

"And in our free time we admire our earth. And again we confirm -- it is beautiful and resembles a bride in a bridal veil of transparent haze. Except that this haze is not white, but instead is of a bluish hue. The continents and oceans can be seen through it clearly. For example, when we flew over South America we could see both its coasts at the same time. You will agree that not too often can one take in an entire continent with a single glance."

"To be sure, we look with particular attentiveness at our Motherland with its enormous expanses. The exceedingly rapid flight of our station over the territory of the USSR lasts for 20-22 minutes. In approaching its boundaries we frequently see how the sun is already rising over the Far East, whereas all the remainder of the country is still shrouded under a cover of nighttime gloom."

"Many natural phenomena are also interesting from orbit. Over North America we observed a thunderstorm as we had never chanced to witness. Gigantic flashes of lightning illuminated the greater part of the horizon. Dense clouds covered the continent, as cream decorations cover a cake. Incidentally, sometimes the opinion is expressed that clouds seemingly duplicate local relief. We did not chance to observe this. For example, over the ocean's smooth surface one can observe formation of something similar to a mushroom with an enormous cap on a thin stem. In general, depending on illumination they acquire the most fantastic configurations."

"Incidentally," noted Boris Volynov, "during my public appearances even before this flight I was frequently asked: 'do space flights affect the weather?' I took advantage of the opportunity to say that of course they do not. We fly above the cloud layer and only help scientists to interpret the weather. And not only the weather. We transmit information on such important factors as atmospheric transparency, and this means,

the degree of its dust content, on the level of contamination of the ocean surface, etc. For example, not entirely understandable bands in the ocean were noted: possibly these are ocean currents and possibly this constitutes alluvium discharged by rivers. We were convinced that they are frequently propagated into the sea for tens of kilometers."
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SCIENTISTS COMMENT ON "SOYUZ-22"

Moscow PRAVDA in Russian 22 September 1976, p 2

[Article by Yu. Khodarev, Deputy Director of the USSR Space Research Institute and K. Muller, Director of the People's Enterprise "Karl Zeiss Jena," Corresponding Member German Academy of Sciences, "Cooperation in Space"]

[Text] The results of the "Raduga" experiment, which on the "Soyuz-22" spaceship is being carried out by the cosmonauts V. Bykovskiy and V. Aksenov, using the MKF-6 multispectral space camera fabricated in the GDR, are being awaited with particular interest by the scientists of the countries of fraternal cooperation. This is a further step in the development of the socialist integration in the field of space research and at the same time is a contribution to a young science -- space geography.

A survey from circumterrestrial orbit promises specialists valuable information in the fields of geology, agriculture, forestry and water management. These data will make possible a more objective evaluation of the state of the earth's natural resources and also the results of the influence of man's activity on the environment.

The multizonal technique for investigating the earth from space has already been under intensive development for several years. Already on the "Salyut" station in 1971 the cosmonauts for the first time carried out a survey using a special high-conformational film for whose processing a special technology was developed. Then on the "Soyuz-12" and "Soyuz-13" spaceships the survey method was developed in different spectral zones and the conditions and method for processing the collected material were also checked out. In the next stage, aboard the "Soyuz-16" and "Soyuz-19," cosmonauts carried out surveys in one of the spectral zones for which the MKF-6 system was designed.

And now the experiment aboard the "Soyuz-22" marks a qualitatively new step in perfecting the method of making a multizonal survey from space and using the collected data for the needs of the national economy. The MKF-6 is a complex optical and electronic instrument giving photographs with a high information content covering great survey areas, this making it possible to satisfy the needs of different users. This same goal is achieved by the use of six spectral channels, the optimum choice of arrangement and width of the spectral zones, the high quality and identity of the geometry and images obtained in all six channels.

The solution of such complex technical problems in a short time was favored by the close cooperation among specialists of the USSR and GDR on the basis of socialist integration. The first joint conferences on the preparation of technical specifications for creating the MKF-6 and the instrumentation for processing the materials, which includes a complex apparatus for obtaining color synthesized photographs, were held in late 1974. And already in the summer of 1976 there was successful testing of the first model of the MKF-6 aboard a Soviet flying laboratory. Everyone participating in implementing the task recognized that they were making a specific contribution to the acceleration of scientific and technical progress on the basis of an international division of labor and socialist cooperation. This made it possible to deal successfully with complex scientific and technical problems.

The basis of the MKF-6 apparatus was the scientific research carried out at the Space Research Institute USSR Academy of Sciences and the many years of technological experience of the enterprise "Karl Zeiss Jena" in the field of optics. In particular, at the Space Research Institute USSR Academy of Sciences specialists formulated the principal recommendations on the conditions for carrying out multizonal photographing of the earth from space. The MKF-6 itself was designed on the basis of the technical specifications of the USSR Academy of Sciences and the GDR Academy of Sciences at Jena at the people's enterprise "Karl Zeiss." Its specialists worked in close collaboration with specialists of the Space Research Institute USSR Academy of Sciences, the Electronics Institute GDR Academy of Sciences and a number of other organizations. Each design decision was carefully discussed, modeled and analyzed. At times up to 600 specialists participated in the work at the people's enterprise. In a very short time the combine was furnished everything necessary -- from special materials, parts and electromechanical units to powerful electronic components.

Tests of the equipment were also made jointly. Some of them were carried out at Jena using special devices created at the enterprise. Then they underwent testing on large test stands and on an aircraft-laboratory in the USSR. Representatives of the GDR and their partners from the Space Research Institute met at Zvezdnyy with the "Soyuz-22" crew. They discussed the fine points of functioning of the equipment under the conditions to prevail in the impending experiment.

All the work was carried out within the framework of cooperation between the USSR and the GDR under the "Interkosmos" program. Its course was also monitored by a permanent subcommission on scientific and technical cooperation of the intergovernmental commission on economic and scientific-technical cooperation between the USSR and the GDR. Accordingly, the direction of the activity of the mixed working groups was put on a parity basis. Due to the total coincidence of interests joint decisions were reached ensuring the maximum advantage for the national economy of our countries and all the countries of fraternal cooperation.

Thus, in the specific example of creation of new multizonal apparatus for study of the earth's natural resources, specialists have once again demonstrated the advantages of socialist cooperation among countries and there has been still further broadening of the sphere of action of socialist economic integration.
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ACADEMICIAN SAGDEYEV ON SPACE MONITORING OF EARTH RESOURCES

Moscow PRAVDA in Russian 18 September 1976, p 3

[Article by Academician R. Sagdeyev, Director of the Space Research Institute, "'Soyuz-22': On the Earth -- from Space"]

[Text] The interrelationships between man and nature, preservation of the environment and rational use of the wealth of the earth's deep layers are highly important problems of our day. Mankind is faced with a demanding problem: how to make maximum use of natural resources and care for the environment. This is now being assisted to a considerable degree by the methods for observation from space and their enormous coverage and routineness. The "Raduga" experiment also pursues this goal. It is being carried out using the MKF-6 multizonal camera, developed jointly by specialists of the Space Research Institute USSR Academy of Sciences and the people's enterprise "Karl Zeiss Jena" in the German Democratic Republic. This article describes the methods, attainments and problems in "space geography."

Now there are few who are surprised that the instruments lifted into circumterrestrial orbit are making it possible to obtain important data not only on the state of the atmosphere and the earth's surface, but even about its deep layers.

The ability to study phenomena situated at a great distance from the observer has long of necessity been the monopoly of astronomy. And astronomers have developed powerful methods for such remote investigation of celestial bodies on the basis of the characteristics of their radiation: first the visible, then the radio wavelength range, etc.

In the earth sciences the first to use remote methods were the meteorologists. The results of analysis of space photographs of the earth's surface are being used effectively in geology. In particular, observations from space have made it possible to discover a whole series of earlier unknown large-scale geological structures. Interest is increasing rapidly in the use of space methods among investigators of the world ocean and water resources. Methods are being developed for remote study of the plant cover on the earth's surface. In general, specialists feel that space technology in the coming years can ensure the creation of a sort of global

space automated system for ascertaining and monitoring the condition of the earth's natural resources.

What problems must be solved on the way to creating such a system?

The basis for investigations of the earth from space is remote methods for measuring its characteristic and scattered electromagnetic radiation. Reference is to a broad range of wavelengths -- from the shortest, measured in thousandths of a millimeter, to the longest, measured in kilometers. True, in such cases one must take into account the degree of transparency of the earth's atmosphere for wavelengths of any length.

The greatest information is carried by the visible range, which at the same time has the broadest spectrum. In this range the nature of the reflected solar radiation is very sensitive, for example, to such physicochemical and biological parameters of terrestrial features as the chlorophyll content in the green mass, moisture and composition of the soils, salinity of water and its contamination, height of waves at sea, the concentration of phytoplankton in it, etc.

The regions of the near and especially the thermal IR radiations react well to the temperature changes of natural formations. In particular, using IR instruments it is possible to detect sectors of vegetation damaged by diseases and therefore having the highest temperature; to detect outflows of geothermal waters, deep faults in the earth's crust, and many other things. The most important advantage of the thermal IR range is the possibility of "seeing" during both the daytime and nighttime.

Radio waves carry less information than IR and light waves. On the other hand, they are capable of penetrating through great thicknesses of terrestrial covers and ice and are very sensitive to the geometrical characteristics of surfaces and also to the moisture content in the soil, the degree of its salinization. The most complete data can be obtained by combining images and other information registered in different ranges, as is the case, for example, in astrophysics in a study of the sun.

The optical multizonal method is now coming into broad use in investigations of the earth from space. The essence of this method is measurement of the radiation of the investigated objects simultaneously in several narrow spectral ranges in the optical interval. The method is based on the use of multiobjective synchronously operating cameras or optical-television scanning systems.

The exposed films are delivered to the earth and are processed. The results of measurements by television systems are registered in digital form and are transmitted through a radio channel. On earth they are decoded and also are transformed into black and white images of the surface for each of the spectral sectors. Then, on the basis of these photographs, assigning an arbitrary color to each range, it is possible to synthesize color photographs. They afford a possibility, on the basis of the relation

of the brightness characteristics of different terrestrial features, to extract a great deal of useful information.

In our country a multizonal survey for the purpose of investigating terrestrial resources was carried out for the first time aboard the "Soyuz-12" and the "Soyuz-13." These experiments revealed its effectiveness in studying vegetation and soils, mapping the shelves, detecting the contamination of water bodies, etc. In particular, using photographs taken from the "Soyuz-12" and showing the northeastern shores of the Caspian Sea it was possible to refine the relief and nature of the underwater vegetation of the shore zone and the shallow-water seas. Specialists compiled a map of soil salinization in the region of the Mangyshlak and Buzachi Peninsulas. There structures were detected which are promising in the quest for petroleum and gas.

In the "Raduga" experiment, which is now being carried out on the "Soyuz-22" ship, the objective is a further study and testing of methods for investigating the earth from space using a multizonal frame camera with a high resolution. Thus, the "Raduga" experiment is still another new stage in studying natural resources of the earth from space. The work is also of a practical nature. In the presence of favorable meteorological conditions plans call for the photographing of considerable sectors of the territory of our country.

Friendly relationships have been established between the Soviet and German specialists who worked together for three years in creating the new cosmic apparatus for surveying the earth. This work once again indicates the productiveness of scientific and technical collaboration among the socialist countries.

It goes without saying that the appearance of the multispectral method does not mean that no further use will be made of surveys in some one spectral zone. They unquestionably are effective in solving different problems, such as in topography.

Now, when investigations of the earth from space are only beginning to develop, it is very important not to scatter, but instead concentrate attention on some definite regions, selecting them as control areas, and there test methods for interpretation of the collected data. A structural study of the spectra of such preselected standard sectors of the earth's surface and comparison of the information from space with the results of investigations carried out by field parties on the ground will afford an opportunity for studying the spectral characteristics of numerous terrestrial features and changes in these characteristics under the influence of different factors. The creation of a "library" of spectral characteristics of different features and phenomena on the earth's surface and in its atmosphere will make it possible to ensure their automated detection and a clear analysis on the basis of the results of space surveys. On the basis of such experimental data it will also be possible to determine the

optimum parameters of survey systems -- the number of spectral regions, their arrangement and width, etc.

For investigations carried out in different geographical regions and in the interests of different branches of science and practice, it may be necessary to have dissimilar spectral regions, spatial and energy resolutions. It is possible that in the future there will be specialized survey instruments and satellites for different purposes -- some for geology, others for agriculture, etc. Now, however, the problem is to optimize the requirements on technical means for investigating the earth from space in order to create a unified space complex which to the maximum degree will satisfy all users of information on the earth's resources and the environment.

The interests of both the scientific and practical use of information require the periodic implementation of surveys of the planetary surface with a resolution of hundreds and tens of meters. In the radiotelevision transmission of these data from space gigantic flows of information arise. Therefore it is necessary to create highly informative digital radio lines and specialized means of high-speed magnetic and photographic registry of the data transmitted from space.

The key problem has become the processing of the collected videoinformation. Indeed, the acceleration of the times here means to increase its useful output. For this purpose it is possible to make extensive use of modern means of automation, especially computers. However, a comparison of the parameters of speed and output of modern universal computers with the volume of space videoinformation reveals the difficulty of constructing on their basis any systems for processing data at a real time scale. Hence the need arises for the specialization of electronic computers applicable to the specific nature of space videoinformation. This specialization applies for the most part to the external devices of the computer. Their makeup must be supplemented by image input-output devices and routine "man-machine" operational communication of the display type.

Thus, investigation of the earth from space constitutes a complex, many-sided scientific and technical problem. Its solution requires the joining of the efforts of scientists and practical workers, designers and engineers, specialists in the most different fields of science and technology. Only through the joint coordinated efforts of many scientific research institutes and design bureaus will it be possible to carry out the tasks defined by the 25th CPSU Congress: a broadening of investigations on the use of space vehicles in a study of the earth's natural resources, in the interests of meteorology, oceanology, navigation, communication and for other needs of the national economy.
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"LUNA-24" DRILLING EQUIPMENT DESCRIBED

Moscow IZVESTIYA in Russian 20 August 1976, p 2

[Article by B. Konovalov, "Lunar Drilling"]

[Text] Each space experiment has its own peculiarity -- an aspect which imprints a special mark on it. This time the special aspect was to be deep drilling. The earlier "space geologists," the "Luna-16" and the "Luna-20" had to deliver to the earth lunar ground after penetrating thirty centimeters into the ground, whereas the "Luna-24" had to penetrate about two meters! In this case it was necessary to take a "column" of ground extending to the entire depth of drilling and return it to earth in precisely that undisturbed form in which it is found on the earth without in any case mixing the layers! And if we add to this that the designers had to adhere virtually to the former weight of the ground-sampling apparatus and conform to the former energy capabilities of the station for drilling rock (and at depth it is evidently harder) and then place the sample in the former ampule of the descent module with the same 40 cm length, one can readily imagine how complex was the problem facing them.

On the newest station it was necessary to place a completely different drill rig. And most importantly, it was necessary to create it.

First of all, the question arose: what is it necessary to drill and how to do this? Indeed, it was necessary to pass this distance through inhomogeneous ground, and what would it be like? It is one thing to drill through unconsolidated loose ground and another thing to drill through rock or even the rocky base of the upper fragmented layer. It is known from drilling practice that for hard ground it is best to have a bit with powerful cutters, whereas for loose ground it is best to use a device which prevents the material from pouring out.

Data from Soviet selenologists were used in developing an analogue of lunar ground which the drill rig could expect at the landing site. The designers themselves decided that their drill rig should also retain performance under more difficult conditions, especially in the case of very unconsolidated ground. In this case the drill tool expects a so-called "arching effect." Try to fill a thin-walled tube with ordinary sand. At first things go easily, but then a sensation arises as if you have met with rock and no forces are capable of bringing about further filling of this tube. This is the action of the cohesive forces between the sand particles and the surface of the tube. A very solid "plug" is created inside.

The designers of the lunar drill rig overcame this barrier by an extremely clever bypass maneuver. The walls of the drill pipe were "clad" in special ribbons capable of being drawn from the outer side of the tube into the internal cavity and enveloping the column of ground as the drill goes deeper. Thus, a new sector of ribbon is "rolled up" around each new

portion of ground and this precludes "plugs" on the lunar "conveyer." In order to facilitate deepening into the ground the drill shaft is rotated.

But this is good when the ground is unconsolidated, but suppose rock is encountered? Then the impact-rotating mechanism of the drill head comes into play. Fragmentation of the ground is accomplished with a two-stage bit with hard "fangs." It can operate as a "slurry drill" which drives holes into the walls and can also rotate, gnawing into the ground. Change from one regime to another is accomplished automatically, depending on the rock resistance.

The beam on which the drill rig is mounted is attached at three points on the side of the lunar automatic station, consisting of the landing stage and the return rocket. The base of the beam consists of two guides on which, like on rails, the head with the drill tool moves downward by means of the delivery mechanisms and system of cables. With deepening of the drill tool into the ground the core with the collected rock is held by the metal ribbons. There are eight ribbons; they work in two layers -- four in each -- so that the ground will not seep into the slits. Naturally, the ribbons are not rigid and they would crumple at the exit from the metal drill pipe. In order for this not to happen, the designers provided for an outer soft tube into which the ribbons with the rock are drawn.

This flexible "ground carrier" in essence makes it possible to place a long, two-meter core in the former ampule with a length of 40 cm. It is wound on the drum of the reloading mechanism. Simultaneously with the winding the drum is moved into the opening of the return vehicle ampule. At the end, when the drilling and winding are finished, a lock is triggered which connects the drum and the drive; this sets free a spring which shoves the entire drum with the ground inside the vehicle. Then pyrotechnic charges shoot off the cable of the delivery mechanism and the upper point of beam attachment. The beam with the mechanisms remaining on it is folded to one side in order not to interfere with the rocket which is being launched to the earth.

When you view this entire structure, twice the height of a man, one gets an impression of lightness and refinement. But behind this refinement, still somehow remaining unnoticed is an extremely clever automatic apparatus which under the severe conditions of the lunar night makes it possible to carry out extremely complex manipulations: stop drilling, slow down, speed up. And it seems that if man himself was on the moon he would not be able to cope better with the task which has been brilliantly carried out by the space robot. The refinement of the structure remains in the shadow together with the enormous amount of work spent in testing and debugging the amazingly clever engineering decisions.

...And now there in the lunar Mare Crisium the flames burst from the engine nozzle. And then the eternal silence of the lunar night is broken by the firey trajectory of the rocket, being launched to its native earth.

Now it is whirling toward us, carefully transporting a precious trophy of modern cosmonautics.
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PREPARATIONS FOR "SOYUZ-22" PHOTOGRAPHY EXPERIMENT

Moscow PRAVDA in Russian 17 September 1976, p 3

[Article by V. Gubarev, "Six Portraits of the Earth"]

[Text] Space flight is not only the testing of human courage and the checking of the perfection of technology, but necessarily is one step into the unknown. Prior to each launching into space scientists are faced with the most diverse problems. A complex of scientific investigations is being carried out aboard the "Soyuz-22." The crew is studying the earth and is carrying out technical or biomedical experiments. In the autonomous flight of the "Soyuz-22" there is still another peculiarity: the ship carries a multizonal camera, the MKF-6, created by specialists of the USSR and the GDR. Yesterday V. Bykovskiy and V. Aksenov made the first survey from aboard the "Soyuz-22." Today we will tell about the preparations for the experiment.

The flying laboratory landed at Erfurt in the evening. The aircraft crew was sent to rest but the specialists of the Space Research Institute USSR Academy of Sciences remained at the airport. They waited until a car arrived from Jena.

The assembly of the equipment began at 0200 hours. Boris Ambrosov and Viktor Gumnik set up the camera and tightened it. The German colleagues assisted them. By morning the assembly was completed.

The scientific director from the USSR, Doctor of Technical Sciences Yu. Khodarev, and the chief designer of the apparatus, Karl Muller, arrived at 0600 hours. First they checked to see whether the camera was operating normally. And then Khodyrev nodded to the fliers:

"Everything is ready. Take off."

You do not sense haste, but at the same time not a single minute was lost. The tests went precisely in accordance with the schedule, which on those June days provided for around-the-clock work.

The aircraft took course for the polygon. Altitude 6,000 m. A test survey was made using three magazines. The film was developed here aboard the flying laboratory. Boris Dunayev, the leading specialist on tests from the USSR, was satisfied with the frames.

The survey of the polygon lasted for five hours. The altitude and course of the ship changed and the sun had already passed half of its daily path; the morning haze rose from the earth; in short, during these hours the photographic conditions varied many times. But the camera stubbornly photographed one and the same sector of the surface -- a special polygon determined by German scientists for careful aircraft, space and ground investigations.

On this same day the aircraft returned to the motherland. Exactly three months remained before the "Soyuz-22" launching.

The American scientist Carl Sagan decided to look at the earth through the eyes of a Martian astronomer. After a careful analysis of surveys of the planet, radar investigations and study of spectra he arrived at the categorical conclusion: "Life does not exist on the earth!" One of the arguments in support of this conclusion was photographs of the planet from space.

"On photographs of the earth taken by the Tiros and Nimbus satellites," writes Carl Sagan, "sometimes it is possible to see cloud formations with an interesting structure. The earth's surface can be seen in gaps between the clouds. But even when the regions appearing on the photographs are related to those regions on the earth where population and vegetation are densest of all, despite the most careful study of them one cannot see the slightest evidence of life..."

Curious findings are necessary for science. They make it possible to understand better the complexity of the problems standing before science and safeguard scientists against hasty conclusions. And this applies, in particular, to photographing the earth from space.

It cannot be said that there are few "portraits" of our earth. Cameras are carried on each manned flight and on many satellites. Millions of frames taken from close and distant orbits are available to the representatives of different branches of science. And nevertheless the questions of how to take photographs from space and what to photograph from space are, if you please, most acute. Photographs are necessary which can be used not only by scientists, but also in practical work: people especially in the land professions -- foresters, agronomists, geographers, biologists, fishermen and geodesists. The crew of the "Soyuz-22" is now obtaining such photodocuments.

The head of the earth research from space division of the Space Research Institute USSR Academy of Sciences Ya. L. Ziman laid out several photographs on the work table. We were surprised by the unusual, to be more precise, unaccustomed colors. The photographs are somehow similar to the drawings of children. Like a child, the "author" of the photographs selected watercolors, and they were generously applied to the paper.

"These are synthesized photographs in artificial colors," explained the scientist, "their information content is very great. Look here: a forested area. Its color is retained only for a hardwood forest; pine forests look red. Different trees have acquired different hues and this makes it possible to determine the species which make up the forested area. On an ordinary black-and-white photograph a grain field is in a single tone, but on such a photograph one can see not only different crops, but also the degree of maturity. In this square field," said the scientist outlining a dark sector, the grain has still not matured. In short, a multizonal survey makes it possible to detect the finest changes in different surface sectors by observations from space. The human eye is incapable of detecting these..."

The new experiment in space has a prehistory lasting many years. First the idea appeared: carry out a survey of the earth's surface in several spectral zones. The rainbow in the sky after a thunderstorm is nothing more or less than light broken down in the spectrum; rain droplets in the air play the role of lenses. In science it is common to use the method of surveys in one of the parts of the "rainbow" -- perhaps the IR, perhaps the UV. But why not take photographs simultaneously in many zones?

The idea of a multizonal survey first received a theoretical basis and later the idea was checked in the first experiments beyond the earth, especially aboard the "Soyuz-12." V. Lazarev and O. Makarov returned to earth about 100 photographs taken in different spectral zones. Analysis of the frames, supplemented by the results of aircraft tests, enabled Soviet scientists to come to the conclusion: it is necessary to have a camera which is more perfect than those now existing which can be used for the needs of the national economy. Soviet specialists, together with their colleagues from the GDR, then proceeded to the development of such a space camera. In order to introduce clarity, it should be said that the "Zenit" or "Praktika" cameras which we amateurs use are not even remote relatives of this camera, although it has objectives and a film. The camera on the "Soyuz-22" is a highly complex scientific instrument saturated with electronic components. Its creation and fabrication in three years (and precisely such was the time from the onset of design work to the ending of the tests) was an outstanding success of specialists in the two countries.

Before the first camera parts appeared at "Karl Zeiss" in Jena, scientists were already firmly convinced that it should be six-zonal and the resolution of the survey should be about 20 meters on the ground. These two figures -- 6 and 20 -- conceal long months of scientific research, discussions and doubts. Why specifically six, and not three or ten? The answer was found after an analysis of the spectral characteristics of two thousand terrestrial features. Green forest, white building, yellow field -- these are our human, that is, subjective determinations of color. How many cosmonauts have already flown, and each of them has differently described the cosmic glow! But a scientific photograph must be precise. How does the same green forest or yellow field look in the spectrum? What part do they "give

preference to?" It is also important to know: what is required from this photograph? For example, if soil moisture content is to be determined, the survey must be carried out closer to the IR zone. In laboratories scientists of the Space Research Institute USSR Academy of Sciences made such a spectral "inventory" of 2,000 terrestrial features. And only after this the designers of the camera received clear recommendations: it is necessary to have six zones in order that the photographs taken from orbit will be useful to specialists in different fields of the national economy.

What resolution to use in taking the photographs? In principle this can be achieved -- technology already allows it -- that on a multizonal photograph one can clearly see the details of a pedestrian's clothing. But the difficulties in such work are too great. The camera must be compact and use little power and the weight cannot be too great; it flies in space, it does not operate on earth. On the other hand, an excess of information, that is, too many details, makes the processing of frames difficult.

Twenty meters is the optimum variant. On the photographs there will be a minimum of the superfluous and a maximum of the necessary.

The requirements on any scientific instrument are extensive. And for a space photograph in particular. That is why after manufacture of the very first "Raduga" units a prolonged series of tests was initiated. A special apparatus was created for these tests which was no less complex than the camera itself. The electrical, optical and mechanical tests for accelerations, vibrations and impacts, all the cycle of tests preceding the birth of a cosmic instrument, were undergone by the camera in the laboratories of the GDR and USSR. And when the first flight model, that which has now taken its place in the "Salyut-22," was completed, an "AN-30" aircraft -- a flying laboratory of the Space Research Institute USSR Academy of Sciences -- landed at Erfurt airport. The camera had passed its examination in the air.

As provided for in the program, the "Soyuz-22" program proceeded to the survey of the earth's surface on the 15th revolution.

"We are flying over Baykal," reported Bykovskiy.

"Visibility is excellent," reported Aksenov. "The cloud cover is two-tenths."

"We are passing along the Lena," says the commander, "and the ship's orientation is excellent."

Yesterday the Flight Control Center was visited by a delegation from the GDR headed by a member of the political bureau of the German Communist Party, the first deputy chairman of the GDR Council of Ministers H. Mittag.

The guests gave a high evaluation of the work of both the cosmonauts and the center responsible for flight control.
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INTERVIEW WITH COSMONAUTS VOLYNOV AND ZHOLOBOV

Moscow IZVESTIYA in Russian 2 September 1976, p 5

[Article by B. Konovalov, "Earth's Attraction"]

[Text] They emerge from their spaceships wavering like seamen after a long voyage. Still in their eyes is the reflection of the surprisingly large, bright stars in the black velvet of the sky. There have not been too many of them, these men who have visited a world which is new for man, the ocean of weightlessness. And therefore each time you listen to what they have to say with some eagerness. Outwardly these are the same people as before the flight, but nonetheless they have changed...

"When we landed, it seemed to me, we emerged from the ship lying on the ground, embraced and kissed it."

"Perhaps I can now envy some living creature," says Vitaliy Zholobov unexpectedly, looking at an enormous clumsy frog which at the sound of our voices sprang from the lawn in front of the "Kosmonavt" hotel.

Here they are on the earth. The medical examinations are over, reports are being prepared and they are helping in analyzing the results of the experiments. The flight has ended. But they are still "there."

"We sleep like we were still aboard the station," says Volynov. At first after return in all cases there was a doctor standing by in the next room. One of them for some reason or another went out at night -- the door slammed just a little. I immediately jumped up. After all, a slam means that something has happened aboard the station. That has to be checked out. With difficulty I realized that I was on the earth. Nothing to it, a door had closed."

Q: Would you please recall how you adapted to weightlessness?

Volynov: This was not very difficult for us. In any case, it was easier than readapting to the earth after the flight. But to be sure, this process transpired gradually. It was necessary to make a good many small day-to-day discoveries in order to get completely used to the station, to best arrange everything. This was similar to the sensation of a city man in the forest. It is by no means easy for him to break trails...

With respect to subjective physiological sensations, on the fourth day in space, upon awakening, I sensed that my condition was far better and now I could work in full strength. On 16 July, that is the date which I wrote in my diary, I understood that I was under absolute control of my body in a state of weightlessness. Usually when working with the complex physical trainer, when you are working out on the treadmill, it is necessary to hang on to special straps or otherwise you will deviate from a position of equilibrium and fall. On this day I decided not to hang on. And it happened. Not only did I run freely, like on the earth, but also did as usual in the exercises, exercised my arms. The coordination of movements under the new conditions was established -- I completely controlled my body.

You become adapted to altitude rapidly and do not think about this. Exactly the same that the workers on high-rise buildings do not pay heed to the dizzying height at which they are working.

Zholobov: This is a very unusual state. Although I had experienced it in aircraft, I knew that one must react so-and-so from what my comrades had said; nevertheless sometimes you involuntarily are thrown and fly like a torpedo to the other end of the station. At times you catch yourself in this -- you are becoming similar to a monkey: your legs work like arms, you grab hold with them, holding onto something, when there is an instrument in your hands. I was very surprised at my first meeting with the station. On the ground, in trainers, we repeatedly "played through" everything. You usually see the horizontally arranged treadmill surface, but here I floated up and for some reason or another it was to one side of me. For me this was like the discovery of a new world.

Q: And how do you think that man can adapt to this world and live there for a long time?

He can adapt and live very calmly [responds Boris Volynov at once]. Man adapts to rather difficult things [notes V. Zholobov] and evidently live a long time under weightlessness conditions. But it seems to me that man is a creation of the earth and he will always be drawn to his native planet.

Q: And how did you see the universe through the station windows?

Volynov: The sky was always black. The Milky Way was bright. The constellations hang like cluster of grapes. You sense the infinite depth of space, you comprehend how tiny our planet is in this enormous universe. You are clearly cognizant of the scantiness of the instant which nature has allocated to us for life. You have to think that the sun shone as brightly when there still was not a single man on earth as it does now. It will shine exactly the same when we are all gone. Our life at the scale of the universe is one tiny flash of a firefly in the nighttime forest. At the same time you feel proud of mankind, which passing the store of knowledge from one generation to the next has been able to burst the chains of gravitation and emerge into space and gradually begin to conquer it.

Zholobov: Here on earth the star sky seems to be two-dimensional, but there it seems three-dimensional. Before landing I observed some planet and directly to one side of it, as the sailors say, a bright star. It was clearly apparent how the black abyss separates the planet from this star. I thought that if we flew to it, it would be a long journey.

Q: You said that during flight at all times you made interesting observations. Would you tell about them in greater detail?

Volynov: Once I saw a meteorite passing alongside. This was on the earth's nighttime side. I hovered at the window and looked at the stars. And suddenly, quite close, moving at the most enormous velocity, which previously I could not even visualize, a meteorite approximately the size of a large fist flew toward the station. It was red hot, with a very long firey tail, and my sensations at these moments were very uncomfortable. Involuntarily I thought, what would have happened if it had not flashed by, but had struck the station? On the other hand, it was pleasant to observe the noctilucent clouds. During the first half of the flight we saw them very frequently, as soon as we had entered into the earth's shadow. They were above the ashen layer of the planet, at an altitude of approximately 60-70 km. We photographed them repeatedly.

Zholobov: As soon as there was a free minute, I looked out the window at the auroras in the polar regions. Above the horizon an aureole appeared in the form of an extended ellipse and above it there were vertical columns of a platinum hue. There was a very faint greenish glow along the edges. An amazingly beautiful spectacle. I observed the mysterious white columns emanating from the earth. Only then did I comprehend that these were the shadows of clouds at sunset. They were moving toward the horizon and moving smoothly into the blackness of the sky. And the sensation was such as if they were moving vertically upward from the earth.

Q: For you what were the most pleasant and difficult things on the earth after the flight?

Volynov: The smell of wheat. The aroma of terrestrial air. It cannot be duplicated. You breathe it in with delight. But the beginning of our terrestrial life was difficult. Gravity is oppressive; it is difficult to stand up and get out of a chair. Now it is already far easier. We walk a great deal, begin to run and are engaging more and more in physical exercises in order to restore the former strength of our muscles, which had become "lazy" during weightlessness. Vitaliy has already gone fishing several times and is dreaming about more distant journeys. One of his kin from Baku got through to the cosmodrome by telephone and he promised on his oath that as soon as the physicians allow he will without fail visit Baku.

Q: On the days of the flight you had a "third crew member" -- the "Zarya" operators with whom you conversed during the communication contacts. What would you like to say to them?

Cosmonauts: We know well all those with whom we held the conversations. They are from our cosmonaut detachment and are also preparing for space flights. Our thanks and deep appreciation to all in the "Zarya" team, to the sailors aboard our science ships, to the personnel of the ground tracking stations, and of course, to the creators of the station, for their self-sacrificing work, since we always sensed their assistance and support. We impatiently await our meeting with them in Moscow in order to express our gratitude to them personally.
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PRESIDENTS OF USSR AND GDR ACADEMIES OF SCIENCES COMMENT ON SPACE COOPERATION

Moscow PRAVDA in Russian 20 September 1976, p 2

[Interview with A. Aleksandrov and G. Klare, "A Flight in the Name of the Future"]

[Text] When three hours remained before the launching of the "Soyuz-22" Academicians Anatoliy Petrovich Aleksandrov and German Klare met with the cosmonauts V. F. Bykovskiy and V. V. Aksenov. The latter told the members of the USSR and GDR delegations which had arrived at Baykonur about the preparations for the flight and about their readiness for completely implementing the program. The guests wished the "Soyuz-22" crew a successful launching, good work in orbit and a soft landing.

The crew of the Soviet spaceship which carried a multizonal camera which had been constructed at the people's enterprise "Karl Zeiss Jena" in the GDR, carried out a series of surveys of the earth's surface. The planned research program is being successfully implemented.

Special correspondents of PRAVDA and TASS, V. Gubarev and N. Zheleznov, met with the presidents of the Academies of Sciences USSR and GDR and asked for commentary on the "Soyuz-22" flight.

Q: How do you evaluate the importance for science and practical work of the experiment prepared by Soviet and German specialists?

A. Aleksandrov: Taking photographs of the earth's surface in six spectral zones is an important new step in study of natural resources for the purpose of their rational use. The apparatus developed in the GDR at the people's enterprise "Karl Zeiss Jena" in collaboration with Soviet scientific and instrument-making organizations is expanding the possibilities of investigating the earth's resources from space. The multizonal photographic system has an adequate resolution for detecting the geological structure of the earth's surface, especially fault zones which usually are especially rich in ore deposits. Photographic surveys from space make it possible to judge

the state of sown crops and forests and help in monitoring the moisture content and appearance of salinization of soils, as well as in evaluating the productivity of agricultural fields.

This apparatus promises much for the national economy, especially in the field of geology and geological prospecting, agriculture and forestry.

It must be noted that the photographic system was developed and "tied-in" to space technology in a very short time, indicative of the fertile and creative work of specialists from the GDR and USSR.

It gave me a great deal of satisfaction to be convinced once again how clearly and smoothly this complex experiment was prepared and implemented. The work of the specialists at the cosmodrome, the engineers and scientists, the developers of the apparatus in our country and in the GDR, as well as the training of the cosmonauts, merit the highest marks.

I take the opportunity to wish Valeriy Fedorovich Bykovskiy and Vladimir Viktorovich Aksenov a safe return to the earth.

G. Klare: I saw a launching for the first time and was completely entranced by it. I was amazed at the unreproachable work of the cosmodrome specialists and the cosmonauts.

We scientists of the GDR are happy that the "Soyuz-22" carries instrumentation developed through the efforts of Soviet and German specialists. Its creation is a result of cooperation between the academies and industry. The contribution of the people's enterprise "Karl Zeiss Jena" was particularly great.

Academician Aleksandrov convincingly stated how important investigations of the earth from space are for the national economy. I am sure that the practical importance of cosmonautics will constantly increase.

I wish the courageous cosmonauts all kinds of success.

Q: What are the prospects for cooperation of the socialist countries in space research?

A. Aleksandrov: The concentration of the efforts of scientists and the joining together of the scientific and engineering capabilities of different countries in creating space technology and research carried out from space vehicles has already brought well-known and outstanding results. It is not at all surprising that the Soviet Union launched the first artificial earth satellite, sent the first man into space, sent the first automatic vehicles to the moon and Venus and has generously shared and intends to share its experience with other countries in the future.

And today we already can state rightfully that a substantial contribution to space research has been made by the scientists combining their efforts within the framework of the "Interkosmos" program.

An excellent demonstration of the effectiveness of this cooperation was the launching of the "Soyuz-22" ship, which carried into space a camera created by the scientists and engineers of the German Democratic Republic in collaboration with our specialists. The results of this joint space experiment, "Raduga," during which we intend to obtain abundant scientific information, are awaited in different branches of science and economics.

The problems which can be solved using space technology are of interest to all mankind. Here are only some of them. How to monitor and prevent contamination of the earth's atmosphere and the world ocean? How to dispose most effectively of the wealth of the planet, which, as is well known, is by no means not unlimited? How to increase the biological productivity of the fields, forests and oceans? We are convinced that the cooperation of the efforts of scientists of the socialist countries, the scientific and technical integration of the countries which are members of the socialist economic block, is a good path to solution of these problems, which are important for mankind.

Taking into account that our planet as an object for study by means of space technology is a sort of unified scientific polygon, we naturally would like to broaden still further joint investigations at this level with the scientists of different countries. The experience of our cooperation with the scientific centers of France, United States, India, Sweden and other countries has already confirmed the high productivity of such a "handshake" between scientists and engineers in space orbits.

G. Klare: I agree completely with my colleage Academician Aleksandrov in evaluating those prospects which are still opening before mankind from the joining of the efforts of scientists of different countries. Whatever may be the contribution of specialists of any of the countries to the joint "Interkosmos" program, multiplied by the coefficient of socialist economic integration, it will exert a considerable influence on the overall scientific and engineering potential of our countries -- all together and each individually. There is no need to emphasize once again the generosity of our Soviet colleagues -- their friendly assistance, their "space universities" -- in assisting the GDR in laying the foundations of space science and technology.

I would also like to speak of those sensations which scientists and engineers of my country experienced in preparing for this joint experiment. The instruments for space research constitute one of the peaks of modern engineering. They concentrate the recent advances in the human experience. For example, the possibility of testing their apparatus in a space experiment is affording the workers of the people's enterprise "Karl Zeiss Jena"

and other scientific and production teams in the GDR excellent prospects for accelerating scientific and technical progress. This is a bright example of how the complex program of socialist economic integration is being embodied.

The problems involved in the exploitation of the natural resources of the planet which stand before science are important and responsible. The flight of the "Soyuz-22" ship specifically favors their solution. The joint work of scientists of the socialist countries serves for the welfare of mankind. And this is inspiring us.
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COMMENTS ON ENVIRONMENTAL MONITORING FROM SPACE

Moscow IZVESTIYA in Russian 27 July 1976, p 5

[Article by K. Kondrat'yev, "Space Nature Service"]

[Summary] Soviet scientists have made a great contribution to the methods for making observations from space and the principles of space ecology as a leading branch of modern space research. Manned space vehicles have proven especially effective in solving scientific and applied problems. They have helped in combining visual, photographic, spectrophotometric and other methods for the remote observation of the atmosphere and the surface of the planet. For example, from the "Soyuz-3" G. Beregovoy observed the formation of dust storms and photographed sectors of the earth's surface which had been subjected to wind erosion. Such observations made it possible to collect valuable information on the degree of erosion of lands and led to the conclusion that dust storms play an important role on the planet as a very powerful factor in filling the atmosphere with dust, which exerts a serious influence on weather and climate. Later, from several manned ships of the "Soyuz" series and "Salyut" orbital stations it was possible to register the spectra of the earth's daytime and twilight horizons. Their analysis made it possible to obtain quantitative data on the dust content of the atmosphere at different altitudes. Will human activity lead to a decrease of ozone dangerous for everything living on the planet? In order to understand this, it is necessary to trace carefully the global distribution of both ozone itself and other gas components of the stratosphere which determine the ozone balance. A successful experiment of this type was carried out using a set of solar spectrometers developed by scientists at Leningrad University. Carried aboard the "Salyut-4" orbital station, this apparatus registered the absorption of stratospheric solar radiation of different wavelengths at sunrise and sunset when its rays penetrated the thickness of the atmosphere along a slant path. Space technology plays a very important role in studying the world ocean. Recently the justified fear has been expressed that the level of contamination of the ocean basins is increasing, resulting in

enormous damage to the biosphere. In this connection the need arises for global observations of the state of the ocean surface. The latest investigations have shown that reliable indicators of contamination are the temperature contrasts of pure and contaminated water registered from space and also the contrasts in the degree of polarization of sunlight reflected by the water. At the same time, observations from space rather precisely make it possible to estimate the content of phytoplankton in the seas and oceans; this is of great importance in searching for the most abundant concentrations of fish. The complex of spectral investigations carried out by Soviet specialists affords specific and broad possibilities for observing the state of the environment on a global scale and also for using methods making possible the automatic (with computers) identification and clear characterization of natural formations on the basis of their spectra. The crew of the "Salyut-5" is using the RSS-2M manual satellite spectrometer which makes it possible to register not only the brightness, but also the degree of polarization of the light reflected by natural features, thereby considerably broadening the possibilities of interpreting data.
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PSYCHOLOGICAL FACTORS IN COSMONAUT PERFORMANCE

Moscow PRAVDA in Russian 18 August 1976, p 6

[Article by A. Pokrovskiy, "How Do You Feel, Cosmonauts?"]

[Summary] During prolonged space flights, under conditions of diminished influx of information, there is a lowering of perception thresholds and the slightest deviations from customary conditions are noticed more acutely. This is reflected in man's mood and performance. There is only one treatment -- a broadening of the range of emotional stimuli. That is why musical recordings and a collection of slides were prepared for the "Salyut-5" crew. Boris Volynov and Vitaliy Zholobov during their free minutes eagerly ask for news and ask that they be told what is transpiring in the country and in the world. A radio communications session with their kin gave them great pleasure. There is another important problem, the "feedback" problem. The workers at the center also had to be psychologically ready for work during the flight, and specifically with this crew. These specialists must know well not only the instruments, but also the people with whom they are dealing in space. A special load falls on the operators who are maintaining direct contact with the cosmonauts. They must do more than know their business; they must communicate to orbit the warmth of their feelings and a lively human interest in the concerns of the crew. During the "Soyuz-5" flight these goals have been achieved. Ship commander Boris Volynov, who himself has repeatedly been a stand-in, understands very well the peculiarities of work at the control center and during the conversations deals with the operator with as much trust as to a third crew member. The operators must solve many problems at once in the course of a communications

session, improvising not only that which must be said, but also how to say it. Psychologists, listening to the conversations, analyze them and give the operators the necessary advice. During such analyses the idea was born of carrying out communication sessions against a background of softly playing music, since it takes away excess tension and provides the cosmonauts additional emotional release. In transmitting any information it is important to take into account the personal tastes of the cosmonauts. For example, Volynov and Zholobov are great sports enthusiasts and each detail transmitted about the course of the Olympic Games gave them new energy. In short, during a long flight many little things not relating to its program exert an influence on the final successful result. [169]

NOTES ON SOLAR RADIATION STUDIES ON "SALYUT-5"

Moscow PRAVDA in Russian 21 August 1976, p 6

[Article by A. Pokrovskiy, "Invisible Face of the Sun"]

[Summary] Prior to launching of the "Salyut-5" specialists prepared a long-range forecast of solar activity. And like a meteorological forecast, it was regularly revised and refined. A large group of specialists in Moscow works on this problem. They collect, generalize and analyze information on radiation conditions in the earth's neighborhood with respect to several tens of parameters. The ship's compartments carry corresponding sensors whose readings are transmitted through telemetric channels. In addition, each cosmonaut is supplied with an individual dosimeter. The sun is calm and the radiation level in the "Salyut-5" cabin is considerably below the admissible level. It is important to improve the prediction method in order to be able to predict not only flares on the sun, but also the composition and energy of the particles ejected into space at the time of a flare, since precisely these characteristics determine to a considerable degree the level of the effect exerted on spaceship crews. Boris Volynov and Vitaliy Zholobov are making their significant contribution to study of the invisible solar disk. Aboard the ship is an IR telescope-spectrometer developed at the Physics Institute. A full IR portrait of the earth is especially interesting. It will help in disclosing many secrets of the structure and composition of the sun. Precisely in the part of IR radiation "forbidden" by the earth's atmosphere one can find the resonance frequencies of many elements and their compounds. But with a full IR solar spectrum on the basis of the brightness and intensity of the spectral lines it is possible in general to judge the presence and concentration of any element in the solar atmosphere. Volynov and Zholobov caught the sun in the mirror of their telescope when it was in the zenith, directly overhead. An IR spectrum was registered each 4 1/2 seconds. Special apparatus transforms it into an electric signal which is transmitted to the earth. In addition, a memory device

stores all the information to the return of the "Soyuz-21." Here in the laboratories at the Physics Institute scientists will carefully investigate the face of the sun which cannot be viewed with the naked eye.
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COMMENTS ON COSMONAUT REACTION TO FLIGHT CONDITIONS

Moscow IZVESTIYA in Russian 17 August 1976, p 2

[Article by B. Konovalov, "Listen, Artek!"]

[Summary] Boris Volynov and Vitaliy Zholobov have already been aboard the orbital station for forty days and are working there self-confidently. Psychologists use the term "sensory deprivation" for the state of a cosmonaut during a prolonged space flight. In many cases the amenities of terrestrial life are lacking in space. A walk on a trainer treadmill is scarcely the same as a stroll through the park. Of course, the cosmonauts have prepared for this for many years on trainers. But the body all the same reacts to space conditions: there is a change in the perception thresholds of individual organs of sense and the cosmonaut senses everything more acutely, such as smells, sounds and temperature fluctuations. And it is far more difficult to monitor the restructuring of the emotional sphere than to trace physiological body changes. From the psychological point of view each cosmonaut is a unique personality and flight only makes this more conspicuous. Boris Volynov is characterized by an increased feeling of responsibility and is absorbed in and highly concerned about all details of the work. On this flight he is the commander and is a more experienced comrade for Zholobov, who is working in space for the first time. And although Vitaliy knows his business well, Volynov strives to assist him. For psychologists this is a wonderful indicator that aboard the ship there is a good, comradely atmosphere. Zholobov clearly manifests his eagerness, high capacity for work, good spirits and happy disposition. The two cosmonauts exhibit a need for company. They very frequently are interested in the news and ask the duty operators for it. Recently music has been played during the communication sessions at the request of the psychologists. This makes the work of the operator a little more difficult, but on the other hand it is pleasant for the crew.
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ADVANTAGES OF SPACE SURVEYS DISCUSSED

Moscow PRAVDA in Russian 1 August 1976, p 6

[Article by Yu. Apenchenko, "General Plan of the Planet"]

[Summary] The coverage in a space survey is far greater than in an aerial survey. This is very important because it is now possible to distinguish features which until recently had remained unknown. In the space, "generalized" view of the earth it is possible to trace such peculiarities in the structure of the planet as earlier had scarcely been suspected. For example, confirmation was obtained for the hypothesis that the Urals, smoothed by time, extend as a geological system far to the south, into Central Asia. And this naturally gives field workers new work in studying the earth's subsurface structure. Completely unknown formations were detected. When enormous (up to several hundred kilometers in diameter) annular structures were detected from space for the first time, this was so unexpected that many scientists reacted to this discovery with distrust. The nature of these annular structures is still unclear. One of the secrets of the distant past of our planet which still remains unexplained. The head of a section at the "Priroda" scientific research center, Igor Konstantinovich Abrosimov, says: "The photographic surveys made from the Soviet orbital stations have made it possible to compile dozens of maps of different regions of our country -- structural geology, geomorphology, soils, landscapes, ground water, etc. They have been made available to specialists. In particular, on the basis of materials from an expedition on the "Salyut-4" it was possible to prepare maps of the Mangyshlak Peninsula and maps of the conservation of nature in the nature of Crimea. Geologists are always especially interested in fault zones in the earth's crust. Many natural treasures have been discovered in places where faults intersect. Aboard the "Salyut-5" interesting geological structures were discovered in the neighborhood of Lake Balkhash and the Caucasus. Volynov and Zholobov had to trace the extent of the faults (they are shaded by bands of vegetation, moistening of the surface and marked rock contrasts). In the Kyzylkum there is a fault associated with earthquakes which was clearly traced from space. In conversations with the control center the cosmonauts noted that an unusually dense cloud cover covered the regions of proposed observations. Investigations under the "Priroda" program had to be postponed. Then at the end of the third week of work the cosmonauts reported: "We see the Caucasus, the Caspian region, the Volga delta and Kazakhstan. We are proceeding to observations and a photographic survey."
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NOTES ON "LUNA-24" SOIL COLLECTION OPERATION

Moscow PRAVDA in Russian 20 August 1976, p 6

[Article by V. Gubarev, "Well Done, Lunar Prospector!"]

[Summary] Another milestone was reached today in the Mare Crisium. The "Luna-24," or to be more precise, its return vehicle with ground, was launched toward the earth. The Soviet automatic station had remained on the moon for only 24 hours. But the volume of work accomplished was enormous. And this

in a unique experiment with deep drilling. This experiment once again demonstrated that today nothing is impossible for an automatic vehicle. The first impression which one gets is that the automatic equipment taking a ground sample on the lunar surface operated with extraordinary ease and simplicity. Seconds after work began the people back on earth were witnessing the event on a television screen. And a new, special drill rig had to be used for operating under lunar conditions. Reports are transmitted back to the earth in a steady stream: "the drill head is moving downward..., 900 mm have been penetrated..." Only ten minutes have elapsed and 1 1/2 meters have been penetrated... The planned depth is reached, the corer is filled and now it must be raised upward and placed in the special ampule situated in the return vehicle. It was possible to take a core with a length of some two meters. It had to be placed in the return vehicle without impairing the sequence of the ground layers. Scientists are receiving ground exactly as it is found on the moon. Only an hour has passed since the landing and there has already been a soft landing on the surface, a borehole has been drilled and ground has been taken. The drill rig, the complex automatic equipment ensuring the transport of the ground and the sealing of the opening in the return vehicle all went off faultlessly. The Soviet station on the moon operates as a minicosmodrome. The landing stage has several purposes. First it ensures a soft lunar landing of the station; then it is transformed into one of the components of the drill rig; finally, it becomes a lunar cosmodrome and serves as a launch pad for the rocket which is to be sent to the earth. One hears the reports over the loudspeaker and one involuntarily wonders whether the information is coming from the moon or Baykonur...
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MEETING ON REMOTE METHODS FOR STUDYING ENVIRONMENT FROM SPACE

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA GEOGRAFICHESKAYA in Russian
No 4, 1976, pp 140-141

[Article by S. V. Zonn, Geography Institute USSR Academy of Sciences, "Scientific Session of the Division of Oceanology, Atmospheric Physics and Geography USSR Academy of Sciences Devoted to Remote Methods for Investigating the Environment from Space"]

[Abstract] A special session of the Division of Oceanology, Atmospheric Physics and Geography USSR Academy of Sciences devoted to an examination of scientific investigations of the environment and the earth's natural resources from space was held during the period 3-4 February 1976. More than 100 specialists participated. The session was opened by Academician L. M. Brekhovskikh. He emphasized that the calling of a special session devoted to an examination of the problems involved in developing and using remote methods for investigating the environment from space is extremely timely. The main

objective of the session is mutual familiarization with the results of work in this field, as well as the development of further research. Flier-cosmonaut V. I. Sevast'yanov told of the scientific results of the last expedition into space and observations and materials on our planet which are being subjected to further investigation. He stated that the human eye from space can see much better and deeper than was visualized earlier. Flying over the Atlantic he saw an underwater ridge. This indicates the unlimited possibilities not only for observations with the naked eye, but also surveys of different kinds. All the subsequent reports presented at the session can be divided into three groups. The first group consisted of review reports devoted to the present status of receipt of space materials and their use in preparing special maps of natural resources by the visual and in part by the visual-photometric method. The second group consisted of reports relating to the development of methods for investigating individual natural processes and resources from space. The third group, the largest, was devoted to an examination of individual technical and geographic problems in space research and their use in evaluating natural resources.
[8]

NOTES ON LANDING OF THE "LUNA-24" RETURN CRAFT

Moscow PRAVDA in Russian 24 August 1976, p 6

[Summary] Helicopters awaited the dawn... The search team required less than a half-hour for precisely determining the landing site of the return vehicle of the "Luna-24." The search center director gave orders to the aircraft to return to their stations and only one "Annushka" remained in the air. This was the craft whose crew had been the first to hear the "voice" of the return vehicle when it had descended by parachute and the center assigned it the task of guarding over the lunar guest until dawn. The aircraft circled over the taiga and at the moment when the "AN" was over the vehicle. The commander reported "Vertical'! Then the coordinates were reported. Finally, it became light in the east. The helicopters immediately took to the air. After several minutes the center received the communication: "I see the object!" As the vehicle had descended the ballistics specialists were calm: the angle of entry into the earth's atmosphere guaranteed a landing in the designated region. With approach of the vehicle the search region was narrowed. First the "landing ellipse" was 2,600 km x 1,600 km. During the half-hour before the meeting of the sphere with the atmosphere the ellipse was reduced by a factor of 25. On a cosmic scale a distance of 100 km is insignificant. But in the Surgut landing region in western Siberia, an area of forests, lakes and swamps, 100 km is not a small zone for a search under such conditions. But the search team had 15 aircraft, 17 helicopters and land search teams at its disposal, all with the most modern equipment. At $20^{h}37^{m}31^{s}$ the descent vehicle entered the atmosphere, like a meteor leaving a firey trail behind it, with direction finders on the ground immediately zeroing in on it. The space vehicle had scarcely touched the earth and three "ANs" already

were circling over it. The landing was made on a sort of island among the swamps. The sharp tops of the trees did not allow the helicopters to land. Then a team member clambered down a cable and crept into the moss to recover the sphere. He lifted it like a baby and climbed into the helicopter with it. The sphere first travelled by helicopter and then by aircraft to Moscow to the factory where it was "born." There the workers who crafted it opened the sphere and removed the ground-filled capsule. In the evening it was already in the receiving laboratory of the Academy of Sciences. [A photograph accompanying the text shows the "Luna-24" station in the last operations of preparing to cover it with screening-vacuum insulation.] [179]

GROUND SUPPORT OPERATIONS FOR "SOYUZ-22"

Moscow PRAVDA in Russian 23 September 1976, p 3

[Article by V. Gubarev, "Pure Sky Under the 'Soyuz'"]

[Text] "Did you get a call?" said one of the laboratory specialists glancing into the office.

"Here's the schedule for the 'Meteors' for October. We will make an aircraft survey of Lake Baykal since there is speculation that the 'Meteor' flights are having a harmful effect on the lake fauna. In addition, it is necessary to check whether or not contaminated water is being dumped into the lake..."

This conversation took place a week prior to the launching of the "Soyuz-22" in the office of the head of the Division of Investigation of the Earth from Space of the Space Research Institute USSR Academy of Sciences Ya. L. Ziman. And the conversation was then continued in space.

"Lake Baykal is beneath us," transmits Bykovskiy.

"Is the camera operating?" says "Zemlya" with interest.

"Yes, everything is normal," responds "Yastreb-2." The survey is proceeding without complications...How beautiful!" says Aksenov without restraining himself.

The "Baykal Scientific Polygon" has been photographed several times from space: the lake itself, the mountains surrounding it, and the forest. Specialists in different branches of the national economy -- geologists and geographers, hydrologists and foresters, geophysicists and meteorologists, are now working in this region. Synchronously with the "Soyuz-22" crew they are carefully studying an unrepeatable creation of nature -- Lake Baykal.

The rational use of the wealth of this region, the preservation of the lake for our descendents, and to be sure, repeated checking on how industrial enterprises are adhering to the preservation regime of this Siberian "sea," such are the problems to be solved by the two men present in space and dozens of their comrades working under the same program with them on the earth.

V. Bykovskiy and V. Aksenov now have many colleagues in the joint research. They are in Fergana and in the Caspian, near Kursk and on Kamchatka, in the Northern Urals and in Western Siberia. About 50 scientific polygons exist in the country. Each of them is a singular standard of nature in our country. For example, the "forest polygon" in Siberia, the Kursk area -- typical for the middle zone of Russia, this is an "agricultural polygon," etc. In each of these careful scientific investigations are being made, not only on the ground, but also from aircraft. Similar "scientific preserves" also exist in the GDR. The "Soyuz-22" crew photographed all these polygons from orbit, so that their study is proceeding at once at three levels -- ground, sky and space.

The complexity of investigations so characteristic for modern science is clearly apparent in an experiment in which the spaceship crew and specialists in different branches of the national economy are participating.

The flight goes smoothly. The communication contact ends as usual. The operator at the Flight Control Center transmits to the ship:

"There is nothing unusual in our telemetric data. Everything is normal."

"The same here," responds Bykovskiy.

The ship passes from the zone of radiovisibility. And immediately the Center and the crew begin to make ready for a new rendezvous, on the next revolution.

At the Flight Control Center near Moscow there is a constant flow of information from the meteorologists -- weather forecasts for the next day and even the next hour. The weather in different regions of the country, understandably, is of interest to everyone. And especially the state of the cloud cover. Precisely it exerts an influence on the conditions for a photographic survey from space.

Among the great many factors why the "Soyuz-22" was launched specifically on 15 September, there was one which was extremely important: meteorological conditions. A clear sky is necessary for a photographic survey. "Grandmother summer" arrives in mid-September. Almost the entire territory of the country is cleared from the dense cover of clouds, exposing forests and fields, meadows and cultivated fields. Well, the calculations were correct. To the east of the Urals the weather was good; it was not completely favorable in the European part of the country. Belorussia, part of the

Ukraine and the Baltic country were covered by clouds, which caused additional concern to the cosmonauts. For the surveys it was necessary to select "alleys" among the clouds...

There was still another peculiarity on this flight. There was a lot of music on it. For several minutes there is an enlivened dialogue between the earth and space. Then come popular songs. Naturally, such a great emphasis on musical accompaniment caused us, the newspapermen, to ask a question of A. S. Yeliseyev: "Listening to good music is certainly pleasant, but does it not distract the crew from their work?"

"During all these days the crew had only a few minutes of free time," says the technical director of the flight A. S. Yeliseyev, "the program is very stressed. Bykovskiy constantly orients the ship and Aksenov is working with the instrumentation. For example, for two hours they pursued the moon from the center of the frame to the edge. The survey was necessary for determining the optical characteristics of the camera. The work was extremely precise. And the music, in addition to satisfaction, insistently suggests to the cosmonauts that the control center at any minute is ready to assist them. We hear every word which is spoken aboard."

"The crew keeps up the radio exchange very literately," continues Yeliseyev, "both Bykovskiy and Aksenov beautifully know the work on the ground, have participated in control of the flight of many ships and therefore there is complete mutual understanding between us. Hence the brevity of the conversations. However, the communication sessions are now longer; the ship has gone into an orbit which makes it possible to carry on a dialogue with the crew for about 20 minutes. On other flights there were very brief communication contacts and much information must be transmitted aboard...Bykovskiy and Aksenov did not and will not have time for distractions. The crew began to work on the first revolution -- immediately after the launching Bykovskiy oriented the ship and no 'gaps' were left in the program up to the landing. This is a peculiarity of the flights during which in a relatively short period of time it is necessary to carry out a considerable volume of scientific research."

"One minute remaining to the end of the communication session," reports the operator, "dine. Good appetite! Evaluate the quality of the food."

"We've already decided," responds Bykovskiy, "it is good."

"And our appetite is 'cosmic'," adds Aksenov, "when we return home you will be convinced."

Yesterday the "Soyuz-22" crew began preliminary operations for landing. [19]

NOTES ON LANDING OF "SOYUZ-22" CREW

Moscow PRAVDA in Russian 24 September 1976, p 1

[Article by V. Vorob'yev and V. Gubarev, "The Country Greets the Heroes"]

[Text] Flight Control Center. The earth, which the cosmonauts so generously photographed from orbit, awaited the return of the "Soyuz-22." In the communication sessions it was more and more common to hear the requests of the physicians:

"'Yastreb-1,' after inhaling hold your breath for 20 seconds."

"I've inhaled," said Bykovskiy falling silent.

"A very curious phenomenon," breaks the voice of Aksenov in the stillness. "The instructions float through the ship. They open up and a circle is formed from the pages. Not the instructions, but a fan."

"'Yastreb-2,' you go through the same procedure now, twenty seconds..."

"I have already done so."

"He is very punctual," laughs Bykovskiy. "Space pleases Voloda. He says 'let's fly some more!'"

The crew is in a good mood. They have worked conscientiously, clearly, smoothly, rhythmically. Everything is ready for the landing. The evening before the cosmonauts and the Control Center had carried out a "general review." Bykovskiy and Aksenov carried the films, log books and scientific documents from the orbital compartment into the descent module. Then they occupied their work places and "played through" all the landing preparation stages as if they were in a trainer.

And now the "Soyuz-22" has begun its last revolution. The crew has perfectly oriented the ship. At these minutes the space bird is flying over our country. V. Vykovskiy says:

"We have checked the airtightness of the spacesuits. Everything is normal."

"You are excellently oriented, lads!" says V. Shatalov. He is now in radio contact with the crew.

"'Yastreby'," transmits the Flight Control Center to the crew, "we are sending you the warm regards of Leonid Il'ich Brezhnev, wishes for a successful termination of the flight and a soft landing. Until we see you again on the ground!"

"Many thanks to Leonid Il'ich for his concern," responds the "Soyuz-22" commander. "We are very pleased by the attention and are happy to report that the mission of the motherland and the party has been carried out."

"'Yastreby,' two minutes remain before the end of the communication session," reminds Shatalov.

"See you soon. Now we will look and see if the pole is there..."

"Is it there in place or not," jokes Shatalov.

The "Soyuz-22" is entering the southern hemisphere. The braking engine was fired not far from the Cape of Good Hope. The vehicle's descent module burst into the atmosphere.

The flight begins in a waterfall of flame generated by the rocket engines. And it also ends in flames: like a meteor, the descent module cuts through the sky. No, it is not falling to the earth, but is floating in the atmosphere in a complex trajectory which provides comfortable conditions for the two space travellers.

The atmosphere cuts down the velocity. The parachute canopy opens up above the ship.

"Attention! The descent module of the 'Soyuz' ship has made a landing on the earth!" The operator's voice is solemn.

The all of the Control Center filled with scientists of the USSR and East Germany explodes with applause. The words most desired this day light up on the television screens: "According to a report from commander V. F. Bykovskiy the cosmonauts feel fine!"

Hans Fisher, director of the Electronics Institute Academy of Sciences German Democratic Republic, embraces his Soviet colleagues and congratulates them. Restrained, thoughtful, Hans Fisher is now excited:

"Beautiful! This is a great day in our life. I bow before the feat of the cosmonauts."

It is not true when they say that science is deprived of emotions. Precisely emotions carry science to greater heights and help in an understanding of its importance. The perfection of technology, multiplied by human courage, makes it possible to carry out unique experiments in the name of mankind. The "Soyuz-22" men worked for each of us. It carried out a survey of the limitless expanses of our motherland and this will help us in making more rational use of our resources.

The "Soyuz-22" expedition has been completed. But the space flight, initiated three years ago at the scientific institutes and at the industrial enterprises of the USSR and GDR, will be continued in the laboratories of scientists, at planning and research institutes.

Tselinograd

An unclear autumn day has come. The search service and everyone associated with the landing of the "Soyuz-22" crew have long been on their feet. It is minutes and seconds until the descent. Everything is preceding normally.

And the tension of waiting is increasing. There is probably nothing which can be done about this. However many meetings there are, all this is repeated. We turn to listen to the cosmonauts Aleksey Arkhipovich Leonov and Nikolay Nikolayevich Rukavishnikov, who are arriving to meet their celestial brothers. Any minute the voices of Bykovskiy and Aksenov will be heard at the command point. The descent module of the "Soyuz-22" vehicle has begun its movement toward the earth. Search team helicopters are being sent into the landing region. One of them carries Aleksey Leonov and Nikolay Rukavishnikov.

And now the bright orange parachute canopy appears in the sky.

An instant and the parachute is shot away. The descent module is on the earth. They are running to meet it. Valeriy Bykovskiy and Vladimir Aksenov emerge from the vehicle. Joyful embraces and greetings.

The cosmonauts glance around the breadth of the fields.

"We saw all this from above when we made a survey over Kazakhstan," says Valeriy Bykovskiy. "And we are happy to be once again in these places."

He, Cosmonaut No 5, knows and remembers the virgin lands well. In Kokchetavskaya Oblast, which borders on Tselinogradskaya Oblast, a monument has been placed at the site of his landing. A cosmonaut of the Gagarin generation, he took his first steps along this earth thirteen years ago.

The cosmonauts in helicopters take course for Tselinograd. At the airport V. Bykovskiy and V. Aksenov are already awaited by the residents of the city and the grain farmers from the nearby state farms. There are bright red autumn bouquets and applause. The cosmonauts are brought fragrant loaves of bread made from the wheat of this year's harvest. By tradition they are handed diplomas as honorary citizens of Tselinograd. V. Bykovskiy and V. Aksenov express appreciation for the warm reception and wish the farmers success in the final, most stressed days of the harvest and they state that all the experiments planned by the crew have been carried out.
[18]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-858"

Moscow PRAVDA in Russian 30 September 1976, p 1

[TASS Report: "'Kosmos-858'"]

[Abstract] The artificial earth satellite "Kosmos-858" was launched in the Soviet Union on 29 September 1976. The satellite was inserted into an orbit with the following parameters:

-- initial period, 101 minutes;
-- apogee, 833 kilometers;
-- perigee, 792 kilometers;
-- orbital inclination, 74 degrees.

SOVIET-AMERICAN CONFERENCE ON SPACE BIOLOGY AND MEDICINE

Moscow PRAVDA in Russian 1 October 1976, p 3

[TASS Report, "Program of Joint Actions"]

[Text] Yerevan, 30 September. Results of biomedical investigations during the "Soyuz-Apollo" joint space flight were discussed at the conference of a Soviet-American group working on space biology and medicine held here. Soviet and American specialists also examined the results of medical investigations on the "Salyut-4" and "Salyut-5" orbital stations and formulated a program for future joint biological experiments. [5]

TASS REPORTS CONTINUING FLIGHT OF "SALYUT" STATION

Moscow PRAVDA in Russian 30 September 1976, p 1

[Text] Flight Control Center, 29 September. In accordance with the planned program, the "Salyut-5" scientific station, which was inserted into a near-earth orbit on 22 June 1976, is continuing in controlled flight in an automatic regime.

The flight of the station is proceeding with constant orientation toward the earth and with a high precision of stabilization provided by the electromechanical system of stabilization which has demonstrated great economy.

In the course of the station's flight in an automatic regime, photos are being taken of individual regions of the territory of the Soviet Union in the interests of science and the national economy. In addition,

tests of the on-board systems are being performed.

By 1200 hours Moscow time on 29 September the station, with which regular radio communications sessions are held, had completed 1,585 revolutions around the earth.

At the present time the station's orbital parameters are:
-- apogee, 270 kilometers;
-- perigee, 256 kilometers;
-- period of revolution, 89.6 minutes;
-- orbital inclination, 51.6°.

According to telemetry information, all on-board systems, equipment and scientific apparatus of the station are functioning normally. Temperature in the station compartments is +21°C. Pressure is 850 mm Hg. The information coming from the station is being processed. [4]

DATA FROM SOLAR POLARIZATION EXPERIMENT ON "INTERKOSMOS-16"

Kiev PRAVDA UKRAINY in Russian 7 September 1976, p 4

[Unsigned article, "Soviet-Swedish Experiment"]

[Text] Soviet scientists have received the first research data from the ultraviolet spectrometer-polarimeter installed on the artificial earth satellite "Interkosmos-16" launched in the Soviet Union on 27 July 1976.

This device was developed by scientists of the Crimean Astrophysical Observatory of the USSR Academy of Sciences and the Lund Observatory (Sweden). The first in world use, it allows the beginning of measurements of the polarization of radiation -- the oscillation of ultraviolet rays coming from the solar atmosphere. This device with a small telescope (focal length 100 mm) and other important components has a mirror adjustment which can register the direction of oscillation of light rays in the ultraviolet regions of the spectrum which are inaccessible to terrestrial observatories.

As the Soviet scientist A. V. Bruns told a RATAU correspondent, the first data received by the Crimean Observatory from the satellite indicate that the device is working normally. Now, with its aid, the layer found between the chromosphere and corona of the sun can be studied.

Concurrently with "Interkosmos-16," observations of the sun are being carried out on the large tower solar and other telescopes of the Crimean Observatory.

"We hope," said A. V. Bruns, "that studies of the polarization of solar rays, which have not been carried out before, will enable astrophysicists to penetrate deeply into the physical nature of processes transpiring on the sun."

ACADEMICIANS PETROV AND GROTE COMMENT ON "SOYUZ-22"

Moscow PRAVDA in Russian 28 September 1976, p 3

[Article by Academicians B. Petrov and K. Grote, "On the Path of Integration"]

[Text] The landing of the "Soyuz-22" descent module ended a space flight which was carried out under the program of cooperation of the socialist countries in the field of investigation and use of space for peaceful purposes. But work on its scientific and practical results has only begun.

But already now it can be said that the Soviet cosmonauts Valeriy Bykovskiy and Vladimir Aksenov reproachlessly carried out the "Raduga" experiment. They carefully prepared for the flight and mastered well the unique MKF-6 camera fabricated at the people's enterprise "Karl Zeiss Jena" in the GDR. Now it is necessary to carry out very responsible operations for processing the films, interpreting the photographs taken and on this basis further developing the methods for studying natural features from space, including the vegetation cover and other characteristics of the earth's surface.

The flight of the Soviet spaceship "Soyuz-22" and the carrying out of the "Raduga" experiment mark a new step in the development of socialistic integration in the investigation and use of space for peaceful purposes. This important matter to an ever-increasing degree is acquiring a complex character and requires the efforts of scientists and physical-technical specialists in different countries.

The Soviet Union, together with a number of other socialist countries, for more than ten years has been successfully implementing the "Interkosmos" program. A broad range of investigations has been carried out using artificial earth satellites of the "Interkosmos" type and "Kosmos" type, geophysical rockets of the "Vertikal'" series, meteorological rockets and ground observation methods. Until recently the investigations covered the problems of space physics, meteorology, space communications, biology and medicine. But now the study of the earth's natural resources from space is becoming an important direction in the research.

It is difficult to overestimate its practical importance. Geology and geophysics, agriculture and forestry, oceanology and land improvement, fishing and glaciology are receiving a new and effective means for studying

natural resources, condition of the soils and sown crops, evaluation of the degree of maturity of different crops, river regimes and ice conditions, detection of regions promising for the search for minerals, etc. Information which is particularly important in practical respects is given by multizonal photography -- simultaneous surveying of the terrain in different narrow sectors of the spectrum of electromagnetic radiation. The apparatus registers both reflected solar radiation and characteristic electromagnetic radiation such as characterizes all heated surface layers.

Taking into account the interests of different branches of the national economy, it is necessary to select the optimum spectral ranges. For this purpose the Space Research Institute USSR Academy of Sciences has carried out major research work and has found six parts of the spectrum which served as a basis for planning the MKF-6 camera. It must be emphasized that the apparatus, in the creation of which a major role was played by the Electronics Institute GDR Academy of Sciences, makes it possible not only to study the surface of the land, but also the ocean and ice cover, and also to carry out precise investigations of the earth's atmosphere and cloud formations.

However, in order that all this become available for use by practical workers and become usable in daily work with a high degree of reliability, it will be necessary to carry out a great amount of research for creating the necessary instruments and facilities for processing data, together with methods for interpreting the collected data. This requires a comparison of photographs from aircraft and space vehicles and a comparison of these with data from a direct study of the photographed terrain -- a sort of multistage investigation. The surveys are being carried out in special sectors of the earth's surface known as polygons containing typical research objects.

During the flight of the "Soyuz-22," in many regions of the territory of the Soviet Union which were photographed from the spaceship, there were simultaneous aerial photographic surveys from aboard aircraft and expeditionary teams on the earth studied the characteristics of the soils, vegetation cover and other peculiarities of the selected sectors. During the time of surveys of individual regions of the territory of the GDR these same regions were also photographed from aboard an aircraft laboratory which carried a multizonal camera similar to the MKF-6.

Without question, one of the most important results of the "Raduga" experiment will be a further refinement and development of the methods for studying natural resources and interpreting the data obtained during multizonal photography from space vehicles. Scientists with great impatience are awaiting the processing of the materials so that they can be used not only for research purposes, but also for the needs of the national economy. In particular, many valuable data can be expected from a study of multizonal photographs of regions in Siberia, the Far East and the territories adjoining the Baykal-Amur rail line.

The solution of such a complex problem as the creation of an optical-electronic multizonal apparatus and preparation of the "Raduga" experiment became possible as a result of development of space research in the socialist countries participating in work under the "Interkosmos" program. During the last decade strong groups of scientific personnel have grown up there; large centers have been established with modern equipment. Ever-larger scientific institutions in the socialist countries are being brought into the work on space themes. Each country is making its contribution to the general program, whatever is possible, and is participating in those experiments which are of the greatest interest for it.

Effective forms of cooperation have been established between the scientific institutes and industry. Many enterprises have been drawn in to the development and fabrication of instruments for space experiments. Here it is possible to mention the "Tesla" combine in Czechoslovakia, the "Karl Zeiss Jena" enterprise in the GDR and others. Cooperation in the use of space is a part of the process of socialist integration in one of the newest fields of modern science and technology.

Now cooperation of nine fraternal countries under the "Interkosmos" program is proceeding into the next development phase. A new generation of Soviet satellites is coming into operation -- automatic universal orbital stations -- and a new generation of geophysical rockets. They will make it possible to formulate still more complex and interesting space experiments. An important new stage in the development of cooperation is the participation of the citizens of Bulgaria, Hungary, GDR, Cuba, Mongolia, Poland, Rumania and Czechoslovakia together with Soviet cosmonauts in the manned flights of Soviet spaceships and orbital stations.

The experience of cooperation of specialists of the USSR and GDR in the preparation of the space experiment and in creating complex apparatus for its implementation and the flight brilliantly made by V. F. Bykovskiy and V. V. Aksenov are indicative of the great possibilities of development of socialist integration in the mastery and use of space technology. The scientists and specialists of the USSR and the GDR, as well as those of other fraternal countries, hope that the scientific and practical "harvest" of the circumterrestrial flight of the "Soyuz-22" ship will be abundant and highly promising.
[26]

DIRECTORS OF "RADUGA" EXPERIMENT COMMENT

Moscow IZVESTIYA in Russian 30 September 1976, p 5

[Article by K. Muller and Ya. Ziman, Technical Director of the "Raduga" Experiment from the GDR and Deputy Scientific Director of the "Raduga" Experiment from the USSR, "Cosmic Rainbow"]

[Excerpt] And now we have become witnesses of the "Soyuz-22" flight; this is the first manned spaceship whose main purpose was an investigation of the natural resources of our planet and monitoring the state of the environment. For this purpose the spaceship carried a multizonal space camera, the "MKF-6." Work on the creation of this camera was carried out under the "Interkosmos" program. It once again demonstrated the effectiveness of scientific-technical and economic cooperation of the socialist countries.

Photographs of the earth's surface obtained from manned spaceships and orbital stations have long been used by scientists and specialists for solving the most difficult problems in the earth sciences and a great many different branches of the national economy. Space photographs are being used successfully in compiling topographic, geological, soils and other maps.

Multizonal photography was carried out from aboard the ships "Soyuz-12" and "Soyuz-13" and the manned orbital station "Salyut-4"; the earth's surface was photographed simultaneously in several narrow zones of the visible and near-IR spectral regions. Using photographs taken in different zones of the spectrum it was possible to ascertain many physicochemical characteristics and state of the earth's natural features.

The multizonal photography method and the task of automating the processing of photographs impose high requirements on equipment. First, the images of one and the same sector obtained in different spectral zones must be geometrically identical to one another. This requirement is attributable to the fact that in the processing of multizonal photographs on an electronic computer and optical instruments they must be matched with an accuracy to several microns. This is necessary for preparing synthesized images integrating the information obtained in different spectral zones. Second, and this is most important, multizonal photographs must with a high accuracy reflect the radiation of the photographed terrestrial features. All these requirements were satisfied to the fullest degree by the "MKF-6" camera, making it possible to carry out multizonal photography in six parts of the spectrum in the wavelength region from 460 to 890 millimicrons.

The theoretical and experimental processing of the method of multizonal space photography, carried out by Soviet scientists, excellent optical components and original design solutions found by the specialists of the GDR, all made it possible to create a unique space apparatus such as was never before known in scientific and applied photography. This opens up new and broad possibilities for the use of surveys from orbit for the most different investigations of the earth's surface.

The high reliability of the apparatus, the simplicity of its control and the great supply of film, making it possible with a single loading of the magazine to photograph more than 20 million square kilometers of the earth's surface, distinguish this space apparatus and make it possible to

recommend its use for carrying out both scientific investigations and practical surveys.

For interpreting the photographs taken under the experimental program implemented on the "Soyuz-22" and given the name "Raduga," specialists at the people's enterprise "Karl Zeiss Jena" manufactured experimental models of the "MSP-4" multispectral projector. This is also an extremely complex and extremely fine optical instrument making it possible from four photographs with the "MKF-6" to obtain color images with a fivefold enlargement. By combining light filters and the intensity of illumination of the initial photographs it is possible to obtain synthesized images of sectors of the earth's surface under conditions of both natural light and in color. The latter makes it possible to see that which cannot be distinguished with the naked eye. For example, identically green forests of different species on a photograph synthesized in conventional colors will have a different hue. The projector can also be used for a visual analysis of the images directly on a screen. On one of these instruments in the GDR and another in the Soviet Union specialists in different branches of the national economy and earth sciences will process photographs from the "Soyuz-22."

What problems have been solved in the "Raduga" experiment and what were the first results of the "Soyuz-22" flight?

First, the problem arose of carrying out tests of the "MKF-6" under spaceflight conditions. In the future it is proposed that the camera be used for surveys of the earth from space. Therefore, it is being subjected to thorough investigations and careful tests.

Today this stage is past. It can be said that the space examination of the "MKF-6" has been passed.

The second task of the "Raduga" experiment is the further development of a method for multizonal photography. For the automated interpretation of photographs it is necessary to know the spectral "portraits" of different terrestrial features, the characteristics of their radiation. Earlier these data were determined on the basis of spectrophotometric studies carried out directly in the field. It is easy to visualize how time-consuming and poorly productive such measurements are. The "MKF-6" makes it possible to use photographs in rapidly determining the spectral characteristics of the photographed formations.

It is true that atmospheric radiation is superposed on the results of spectrophotometric study of the earth from space. In order to exclude it and obtain standards or keys for the interpretation of space photographs, photography from aboard the "Soyuz-22" in individual regions was accompanied by synchronous surveys from aircraft and ground inspection of the surveyed sectors. On one of these complex expeditions, organized by the Space Research Institute USSR Academy of Sciences a camera which was a "double" of that used on the "Soyuz-22" was carried aboard an An-30 flying laboratory.

Synchronously with the cosmonauts, this expedition carried out a survey first in the USSR, in the neighborhood of the Fergana valley, and then in the GDR.

The mission of the "Soyuz-22" flight included the photographing of extensive territories of the Soviet Union and the German Democratic Republic at the request of many economic organizations. These orders were for the most part carried out and a high percentage of the photographs returned to the earth will be used for practical purposes, for solving the most diverse national economic problems. These include the quest for minerals, the investigation of soils and vegetation, monitoring the use of forest resources, hydromelioration mapping and the detection of sectors of increased plankton concentration in the seas and oceans...

The specialists of the German Democratic Republic intend to solve more than a few practical problems using photographs taken from the "Soyuz-22." In particular, they have planned a broad program for monitoring contamination in the GDR environment. Plans call for determining the contamination of rivers, lakes and the Baltic shores by industrial waste water, ascertaining the presence of harmful impurities in the air over cities, industrial and densely populated regions. It should be noted that scientists and specialists of the USSR and GDR intend to solve these problems on the basis of the most broad cooperation.

In summarizing the first results of the "Soyuz-22" flight and experiencing great satisfaction with respect to the faultless operation of this apparatus launched into space for the first time, we wish to express our exhilaration concerning the reproachless work of Vladimir Aksenov and Valeriy Bykovskiy. Their excellent knowledge of the equipment, excellent preparation for the flight and professional understanding of the problems of investigation of natural resources of the earth to a considerable degree ensured the the success of the "Raduga" experiment.
[31]

MONOGRAPH ON THE MECHANICS OF SPACE FLIGHT

Moscow MEKHANIKA KOSMICHESKOGO POLETA, PROBLEMY OPTIMIZATSII in Russian
Izd-vo "Nauka," 1975, 665+ pages

[Monograph by G. L. Grodzovskiy, Yu. N. Ivanov and V. V. Tokarev, "Mechanics of Space Flight. Problems in Optimization"]

[Abstract] This book gives a systematic exposition of the mechanics of spaceflight. The object of this branch of mechanics is the joint solution of the problems in selecting the optimum design parameters of a spacecraft, optimum control of its engine system and optimum flight trajectories. In comparison with the preceding book by these same authors (MEKHANIKA

KOSMICHESKOGO POLETA S MALOY TYAGOY (Mechanics of Low-Thrust Spaceflight), "Nauka," Moscow, 1966), in this book the authors have included new sections devoted to the optimization of vehicles with a high-thrust engine and the problems in choice of the parameters and controls under conditions of uncertainty (games and statistical approaches to the optimization problem). In addition, the old sections are supplemented by new results which have been obtained since the publication of the preceding book. The book is intended for engineers, scientific workers, graduate students and students in advanced courses. 31 tables, 536 illustrations, bibliography of 1,107 items.

[24]

PREPARATIONS FOR STUDY OF LUNAR SOIL SAMPLE

Moscow PRAVDA in Russian 23 August 1976, p 4

[Article by V. Gubarev, "The 'Lunar House' Awaits the Soil"]

[Summary] The soil sample taken by "Luna-24" on 18 August 1976 was sent to the laboratories of the Institute of Geochemistry and Analytical Chemistry in Moscow... The capsule is in the chamber. The vacuum pumps have evacuated the air. The operator removes the "ground carrier" from the drum and lays it on a special surface. The coiled ground carrier resembles a conch shell. After weighing, the spiral is x-rayed. The x-ray photographs show how the lunar load is arranged in the ground carrier. Then the spiral is cut open. This operation is very precise because the ground must not be mixed; it must be retained in the same form as it was found on the moon. Long prior to launching of the "Luna-24" the laboratory had begun preparations for its payload. A precise duplicate of the "Luna-24" capsule was brought from the factory. Only the filling of the ground carrier was different: the lunar ground was replaced by basalt. A "general rehearsal" was held at the laboratory. "Our task," stated the Deputy Director of the Institute Yu. A. Zolotov, Corresponding Member USSR Academy of Sciences, "was how to least disturb the lunar ground. There will be two cycles of investigations. One will last four or five days, a sort of 'first familiarization.'... But a more detailed study will take about a month. We are using chemical analysis methods which do not destroy the ground. For example, a so-called 'electronic probe.' A beam of electrons is directed onto a 'tablet' of matter and x-radiation is excited in it. It tells about the elements present in the ground. By this method we will determine 10-12 of the most important ones -- aluminum, calcium, iron, etc. Using a spark mass-spectrometer it is possible to obtain a 'chemical portrait' of 60 elements. Finally, the 'tablet' is irradiated by neutron beams. They cause secondary gamma radiation which also tells about the elements present in the matter. Thus, by the beginning of October we plan to carry out preliminary investigations of the ground from the Mare Crisium and then it will be put into containers and sent to our 'lunar warehouse.' From there the samples will be sent to different research institutes in the USSR and other countries... Naturally, work with the ground will continue for many years at our institute..." Was anything unexpected found in the lunar samples? Yes, iron which will not rust. It has been noted that if such iron could be produced on earth the economic advantages would be so enormous that the entire cost of the space program would be paid for many times. Indeed, such iron was then produced in the institute's laboratories. But in a deep vacuum. Perhaps one day special factories in the vacuum of space will make it possible to produce vast quantities of nonrusting iron for shipment back to the earth...
[182]

FORECASTING OF IONOSPHERIC RADIATION

Moscow IZVESTIYA in Russian 13 August 1976, p 4

[Article by V. Shmyganovskiy, "Echo of Solar Storms"]

[Summary] Specialists at the Institute of Applied Geophysics of the USSR Hydrometeorological Center have been assigned the task of monitoring and predicting the behavior of the radiation belts and cosmic rays which constitute a danger primarily for the crews of spaceships. Academician Ye. K. Fedorov, institute director, has pointed out that the service needs specialists for this purpose who are experts on solar behavior. A division with an unusual name was established: division of routine monitoring and prediction of heliogeophysical conditions. Instruments created at the institute and carried aboard "Meteor" satellites periodically by means of sensors report on the passage of the satellite through zones of charged particles. Stations located in the territory of the country are receiving and interpreting these signals. By comparing the collected data with data on solar radioemission, as well as the results of optical observations, it is possible to predict radiation conditions at different altitudes for several days in advance. At the institute specialists have learned with considerable accuracy to prepare forecasts of the state of the ionosphere, whose behavior must be taken into account in order to ensure stable radio communication. Ionospheric stations from different geographic zones of the country send radio signals aloft and receive reflections from an altitude of several hundred kilometers. This information makes it possible to recommend to the communication services in what range radio exchange should take place on any particular day. The ionosphere is very dynamic. The reflecting layer, saturated with electrons, changes in form and altitude. This is also associated with solar activity. Experts noted that as a result of the solar storm of August 1972 there was a slowing of the earth's rate of rotation and this, think some scientists, led to local weather changes. It is very difficult to foresee each new solar explosion, but from experiment to experiment the forecasters are improving their results. This is favored, in particular, by an exchange of information with all interested countries. Improvements are being made not only in instrumentation, but also in prediction methods. In particular, image identification methods are being used. On the basis of the form, coordinates, dimensions and other characteristics of active regions on the sun specialists are learning to predict the period of its maximum excitation, the time and intensity of flares. In the immediate future the institute is planning to use a computer which will be capable of rapidly generalizing the collected information and instantly issuing a forecast.
[171]

REVIEW OF PROCEDURES IN TESTING SPACESHIPS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, 1976, pp 38-39

[Article by Engineer G. Maksimov, "Spaceship Tests"]

[Summary] The first part of this review describes tests on spaceships on the ground and in the factory; the second part deals with tests in the air. After ground testing the in-air tests begin. The effectiveness of thermal shielding of the descent module and the controlled descent system, for example, are checked using geophysical rockets. A model of the descent module is put beyond the limits of the dense layers of the atmosphere. Here it is separated from the rocket and makes a controlled descent. Telemetric sensors register temperature, the wearing away of the heat-shielding covering and operation of systems during descent. As a result of the flight tests it is possible to refine the aerodynamic and ballistic characteristics of the descent module, the accelerations operative during descent, dynamic and heat fluxes. The parachute system and the soft landing systems are tested by ejecting the descent module from an aircraft. This is done with adherence to all the conditions for activation of parachute systems: descent module flight velocity (about 200 m/sec), its spatial orientation and the descent trajectory profile. In such tests it is possible to determine the admissible angles of attack of the descent module at the time the parachute system is activated and the maximum velocity heads acting on the parachute. The strength characteristics and performance of different elements of the system are investigated. The correctness of shooting away of the hatch covers is checked. When the aircraft rises to the necessary altitude and reaches the necessary velocity, the descent module is separated from it; it then completes independent flight and is stabilized until the time when the parachute system is activated at an altitude of 10 km. Further descent is by parachute. The dynamics of all components of the parachute system is studied. Personnel aboard the aircraft make a motion picture survey of the canopy emerging from the parachute container, the process of its opening and operation during descent. The landing of the descent module is tested during its landing on different surfaces: snow, water, soil and rocky ground. Sea tests are made for ascertaining the degree of safety of the descent module during its presence afloat. For this purpose the descent module is dumped into the water. Inside the vehicle are the crew members and all the systems necessary for their life and work. The cosmonauts test methods for abandoning the descent module, surviving in the water and evacuating by means of helicopters and ships. In order to ensure rescue of the cosmonauts in case of an accident to the carrier-rocket during launching and when the ship is being put into orbit there are special solid-fuel engines which separate the ship in cases of danger and throw it to one side of the carrier-rocket. In the course of the tests the most unfavorable possible conditions are created. Telemetric sensors register the operation of all systems. [174]

Abstracts of Scientific Articles

METHOD FOR DETERMINING ORBITAL ELEMENTS OF ARTIFICIAL PLANETARY SATELLITE

Moscow IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 2, 1976, pp 61-67

[Article by M. S. Urmayev, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Approximate Determination of Orbital Elements of an Artificial Planetary Satellite from Photographs of the Planetary Surface and Star Sky"]

[Abstract] In studying the moon and planets the problem arises of determining the approximate orbital elements of an artificial planetary satellite which then can be refined using data from photometric measurements. In the absence of measuring apparatus on the planetary surface, the method for determining an orbit can be based on an analysis of the photographs taken from aboard an artificial planetary satellite. In this paper it is shown that the problem can be solved using synchronous photographs of the planet and the star sky obtained from aboard the artificial planetary satellite using "topographic" and "star" cameras whose elements of relative orientation are known and invariable in the course of the survey. In this case the optical axis of the "topographic" camera must approximately track the center of mass of the planet and the rotation of the space vehicle about its characteristic vertical axis must be reduced to a minimum. It is shown further that for unambiguous determination of the orbit in this case it is sufficient to have two photographs of the planet and two photographs of the star sky. In this process, on each of the planetary photographs it is necessary to have a minimum of two points with known planetocentric coordinates.
[146]

DETERMINING SATELLITE ORBITS FROM RADIAL VELOCITY MEASUREMENTS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 8, 1976, pp 7-11

[Article by V. V. Boykov, "Accuracy in Determining the Orbits of Satellites from Measurements of Their Radial Velocity"]

[Abstract] In an earlier study (V. V. Boykov and K. V. Malets, "Accuracy in Determining the Coordinates of Observation Stations Using the Radial Velocity of a Satellite," GEODEZIYA I KARTOGRAFIYA, No 9, 1975, pp 17-24) the author gave an analysis of the accuracy in determining the position of observation stations on the basis of the radial velocity of satellites and it is emphasized that the accuracy of station coordinates is essentially dependent on the errors in the position of satellites in orbit. Accordingly, the author felt it desirable to analyze the accuracy in determining the orbits of satellites on the basis of measurements of radial velocity relative to observation stations with known coordinates. This is done using the method, system of coordinates, notations and limitations adopted in a paper by the author and I. A. Lutfullin ("Accuracy in Determining the Coordinates of Observation Stations and the Orbits of Satellites Using Measurements of Distances to Artificial Earth Satellites," GEODEZIYA I KARTOGRAFIYA, No 12, 1975, pp 11-22).
[3]

MOTION OF BALLISTIC VEHICLE DURING ATMOSPHERIC REENTRY

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 4, 1976, pp 491-497

[Article by V. S. Aslanov, "Rotational Motion of Ballistic Axially Symmetric Vehicle During Atmospheric Reentry"]

[Abstract] A study was made of the spatial uncontrolled motion of a flight vehicle of spherical form relative to the center of mass during descent in the atmosphere. The author has determined the set of parameters for the vehicle and the initial conditions for which the angle of attack along the trajectory does not exceed some limiting value.
[198]

SOLAR WIND INVESTIGATIONS ABOARD "PROGNOZ" SATELLITES

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 4, 1976, pp 569-577

[Article by O. L. Vaysberg, F. Cambou, A. V. Bogdanov, Zh.-M. Boske, A. N. Gerberg, A. A. Zertsalov, I. P. Karpinskiy, B. V. Polenov, S. A. Romanov, V. V. Temnyy and B. I. Khazanov, "Some Problems in Investigating the Solar Wind on 'Prognoz' Satellites"]

[Abstract] This is a discussion of some problems in investigating the solar wind aboard high-apogee artificial earth satellites of the "Prognoz" type. The instrumentation used in solving the formulated problems is described.

A complex of plasma spectrometers is described: RIP-803, RIP-804, "Kalipso", RIP-801 and RIE-204. The RIP-803 mass-energy analyzer is designed for the separate measurement of the principal ion components of the solar wind -- the proton and α-components and also ions having a mass-to-charge ratio m/q = 4. (Figure 1 is a structural diagram of this instrument, which like the others, is described in detail in the text.) The RIP-804 ion spectrometer is designed for measuring ions in the energy range 0.1-4.5 keV per unit charge (a structural diagram of this instrument is shown in Fig. 2). The "Kalipso" spectrometer is designed for simultaneous measurement of the spectra of ions and electrons in the energy range up to 17 keV, as illustrated in Fig. 3. The RIP-801 proton spectrometer is designed for measuring the energy spectra of ions in the energy range up to 7 keV and is a combination of an electrostatic analyzer with deflection and an analyzer with a retarding potential, as illustrated in Fig. 4. The RIE-204 electron spectrometer is used for measuring the electron flux in the energy range from 30 to 150 eV. The instrument is an electrostatic analyzer at whose output there is a scintillator and two photomultipliers, connected in a coincidence circuit. Each of the instruments is described in detail.
[198]

INTERRUPTION OF RADIO CONTACT DURING DESCENT ON MARS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 4, 1976, pp 610-615

[Article by L. I. Vasil'yeva, L. M. Grigor'yev, V. V. Kerzhanovich, A. F. Korenchuk, V. A. Pugachev, V. I. Rogal'skiy and G. Ye. Starchenko, "Determination of Time and Limits of Interruption of Radio Communication During Entry of Descent Module of the 'Mars-6' Interplanetary Station into the Martian Atmosphere"]

[Abstract] The author has determined the time and limits of interruption of radio communication during entry of the descent vehicle of the "Mars-6" automatic interplanetary station into the Martian atmosphere. For experimentally refined trajectories and models of the Martian atmosphere it was possible to make repeated computations of the gas-dynamical and radiophysical parameters of plasma and determine the time and limits of interruption of radio communication. On the basis of the results of computations for three variants of the chemical composition of a refined model of the Martian atmosphere (100% CO_2, 90% CO_2+10% N_2, 75% CO_2 + 25% Ar) it was possible to determine the electron concentration in the nonviscous layer in dependence on the time of space vehicle descent. The computed interval of radio contact interruption was: for 100% CO_2 -- about 59 sec, for 75% CO_2 + 25% Ar -- about 64 sec, for 90% + 10% N_2 -- about 68 sec. There was a good agreement between the experimental and computed data.
[198]

SOLAR COSMIC RAYS DURING FLARE OF 29 APRIL 1973

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 40, No 3, 1976, pp 457-461

[Article by G. A. Bazilevskaya, L. V. Kurnosova, V. I. Logachev, L. A. Razorenov, Yu. I. Stozhkov and M. I. Fradkin, "Observation of Solar Cosmic Rays During Flare of 29 April 1973"]

[Abstract] Instrumentation carried aboard the "Kosmos-555" vehicle and stratospheric flights made it possible to investigate solar cosmic rays during the flare of 29 April 1973. At that time there was a sudden commencement of a cosmic ray burst at a frequency of 2800 MHz at 2056 UT. The intensity of the radio emission at this frequency attained about $1800 \cdot 10^{-22}$ $W \cdot m^{-2} \cdot Hz^{-1}$. During the flare period there was an increased intensity of solar X-radiation in the ranges 1-8 and 8-20 A (about 1-0.05 keV). The intensity in the indicated ranges increased by factors of approximately 100 and 40 respectively. Figure 1 shows the time dependence for proton fluxes of solar cosmic rays as determined by different authors; Fig. 2 gives the corresponding data for the "Kosmos-555" and other figures graphically present other supplementary data. The "Kosmos-555" instrumentation made it possible to register solar cosmic ray protons with energies $\sim$175 MeV and $\sim$400 MeV. An appreciable increase in fluxes during the flare was observed only in the polar caps and was completely absent at the equator. The satellite and balloon data are compared. It was found that the results of measurements with the narrow-angle telescope on the satellite agree well with data from stratospheric measurements. The fluxes measured with the wide- and narrow-angle telescopes have a difference indicating an angular dependence of the flux of solar cosmic rays during this flare. All this indicates a complex nature of the motion of solar protons in the geomagnetic field.
[93]

METHODS FOR INVESTIGATING COSMIC RAY VARIATIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 40, No 3, 1976, pp 646-650

[Article by T. M. Aleksan'yan, V. M. Bednazhevskiy, Ya. L. Blokh, R. T. Gushchina, L. I. Dorman, I. Ya. Libin, F. A. Starkov and V. G. Yanke, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation and Kursk Polytechnic Institute, "Development of Ground Methods for Investigating Cosmic Ray Variations"]

[Abstract] The paper consists of four sections. 1. Some problems in increasing the accuracy in registering the nucleon and ionizing components of cosmic rays. Figure 1 shows a system for automatically excluding single and double random coincidences. 2. Coupling coefficients and barometric effect

for "stars" of different multiplicity with allowance for random coincidences using the results of expeditionary measurements of the neutron component aboard the "Akademik Kurchatov." Working in the Atlantic Ocean during the period June-October 1974, specialists aboard this vessel investigated the planetary distribution of the intensity of the neutron component and stars with a multiplicity 1, 2, 3, 4, 5, $\geqslant$ 6. The measurements were made using a standard neutron monitor and an attachment for the registry of stars with the automatic exclusion and without exclusion of random coincidences. 3. Computation of coupling coefficients using observational data from the world network of stations. It is shown that after calibration of the network of stations, by using normalized data for several stations it is possible to construct the latitude dependences and find the coupling coefficients for any stipulated moment in time. 4. Coupling coefficients for the vertical muon telescope at a depth of 60 m water equivalent. The coupling coefficients obtained by different authors are compared.
[93]

VIBRATION EFFECTS IN WEIGHTLESSNESS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 230, No 1, 1976, pp 48-51

[Article by R. F. Ganiyev, V. D. Lakiza and A. S. Tsapenko, Mechanics Institute Ukrainian Academy of Sciences, "Vibration Effects During Weightlessness and Prospects for Space Technology"]

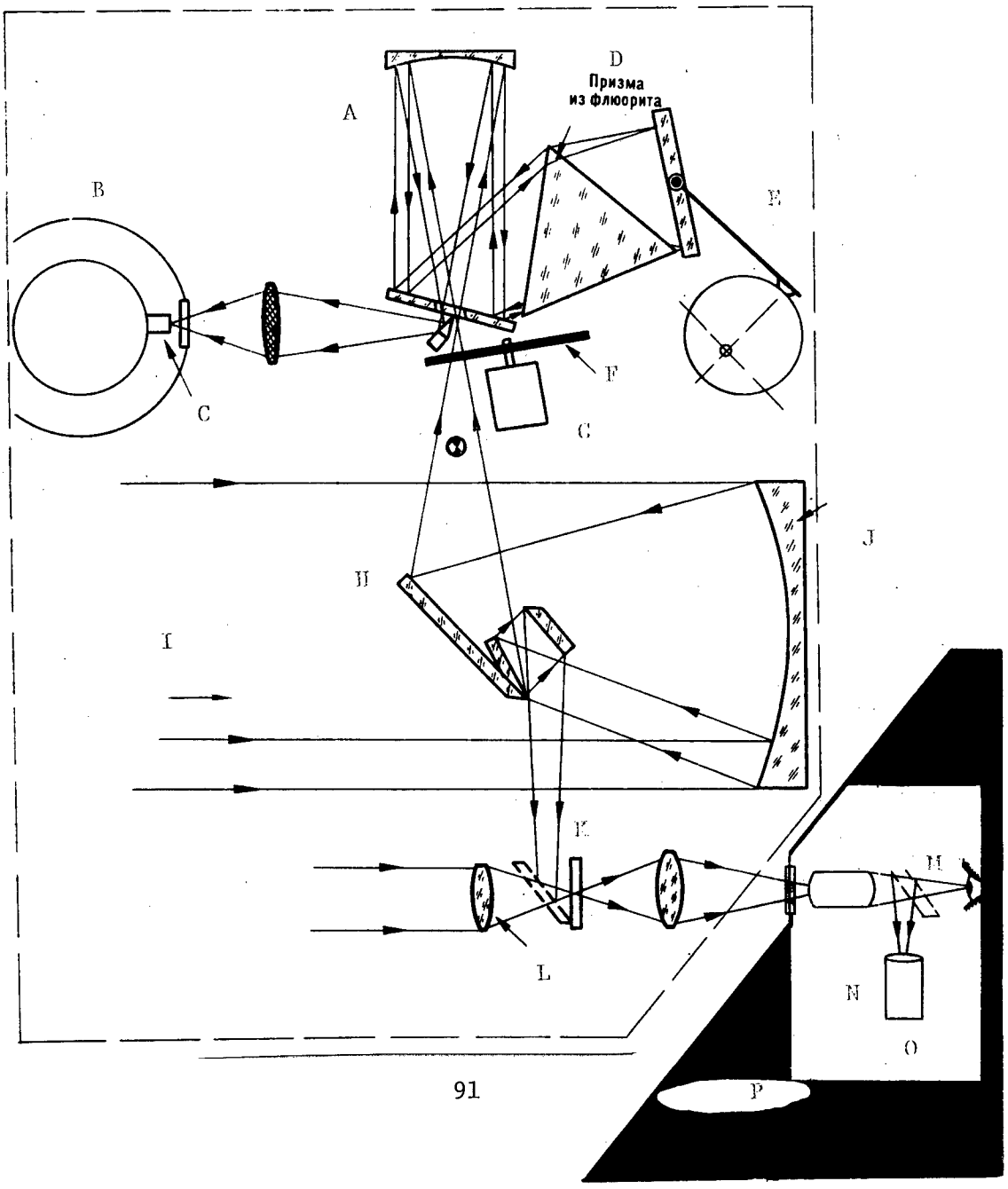
[Abstract] The objective was an investigation of stable equilibrium states and movements of fluid media with gaseous and solid inclusions (multiphase media). Series of experiments were carried out for this purpose in a flying laboratory making a flight in a parabolic trajectory. Near-weightlessness conditions were realized. The aircraft carried a vibration apparatus with different auxiliary devices developed at the Mechanics Institute Ukrainian Academy of Sciences; this made it possible to measure, photograph and excite controllable vibration movements of a multiphase medium in a wide frequency range. The investigated models were transparent cylindrical shells partially filled with water with solid particles and condenser oil. The experiments revealed the existence of specific vibration effects arising in multiphase media. These include: resonance mixing of fluids which do not mix on the earth (including those with solid inclusions), the formation of stable periodic layered structures and the appearance of specific caverns and "funnels" on the free surface of the fluid. These phenomena must be taken into account in formulating and solving practical problems in the dynamics of bodies with a fluid and a gas and these are recommended for use in the realization of a number of technological processes during weightlessness, such as obtaining layered and foam materials, materials reinforced with "foreign" inclusions, etc. It is shown that a number of technological processes in space are based on possible equilibrium forms and movements of fluid media with different inclusions during weightlessness caused for the most part by surface tension forces.
[12]

INFRARED EXPERIMENT ON "SALYUT-4"

Moscow ZEMLYA I VSELENNAYA in Russian No 4, 1976, pp 18-24

[Article by M. N. Markov, "Infrared Experiment on the 'Salyut-4'"]

[Abstract] The IR telescope-spectrometer carried on the "Salyut-4" is described. It operates at wavelengths 1-8μm, making it possible to study the molecular components of the earth's atmosphere, water on the earth and in a nebula 10 kps from us, the daytime and nighttime earth, structure of the earth's atmosphere and the reflectivities of lunar ground.



KEY TO FIGURE: A) Compartment for scientific instrumentation; B) Cryostat; C) Detector; D) Fluorite prism; E) Mirror for scanning of spectrum; F) Modulator; G) Standard source; H) Turning mirror; I) Investigated radiation; J) Main mirror; K) Scale; L) Wide-angle objective of sight; M) Image converter; N) Window; O) Motion picture camera; P) Station cabin

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A photograph accompanying the text shows the "Salyut-4" in the factory. The ITS-K (infrakrasnyy teleskop-spektrometr kriogennyy -- cryogenic IR telescope spectrometer) was designed and constructed at the Physics Institute USSR Academy of Sciences. Two photographs show the ITS-K and its spherical cryostat and the ITS-K sight. The instrument is fully described. A diagram shows observations of the moon and the earth's atmosphere at altitudes from 140 to 350 km. The crew's work is discussed and some of the preliminary results are presented. For example, from the "Salyut-4" station it was possible to obtain the spectrum of IR radiation of the upper atmosphere corresponding to an altitude of 140 km. Since the radiation is concentrated in the wavelength range 5.1-5.6μm, it can be assumed that the most probable emitter is the nitrogen oxide molecule. This is true at least in the middle and low latitudes where the measurements were made. [173]

COMBINED MANEUVER OF ROTATION OF ORBITAL PLANE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 4, 1976, pp 498-503

[Article by V. L. Balakin, V. M. Belokonov and V. M. Shershnev, "Combined Maneuver of Rotation of the Orbital Plane in the Presence of Restrictions on the Motion Regime"]

[Abstract] In earlier studies (such as V. L. Balakin, et al., KOSMICH. ISSLED., 12, 3, 346, 1974) the author and others developed programs for the control of a spacecraft in the combined maneuver of rotation of the orbital plane with the use of jet-aerodynamic maneuvering without taking into account possible restrictions on the motion regime. In this new paper the author determines the optimum and approximately optimum regimes of motion of a spacecraft, taking into account restrictions on acceleration and the surface temperature of the vehicle. The article examines the combined maneuver of rotation of the plane of a circular orbit with a three-impulse structure. The first velocity impulse is imparted at the altitude of the initial orbit and ensures the entry of the spacecraft into the atmosphere with a stipulated angle of trajectory inclination. The second impulse puts the vehicle into a transitional ellipse whose apogee is situated at the altitude of the final orbit. The third impulse is imparted at the apogee of the transitional ellipse and restores the spacecraft velocity to orbital velocity. The article gives an evaluation of the influence of restriction

on the gain in weight of the spacecraft when using a combined maneuver in comparison with a rocket-dynamic maneuver.
[198]

"KOSMOS-426" INVESTIGATION OF TRAPPED RADIATION

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 14, No 4, 1976, pp 637-641

[Article by S. N. Kuznetsov, G. B. Lopatina, V. V. Mel'nikov, I. I. Pervaya, I. A. Savenko, B. I. Savin and V. G. Stol'povskiy, "Investigation of Trapped Radiation on the 'Kosmos-426' Artificial Earth Satellite. IV. Structure of Electron Fluxes at Outer Boundary of Geomagnetic Trap"]

[Abstract] Data are given on the distribution of electrons of different energies in the high latitudes in the altitude range 400-2,000 km obtained on the "Kosmos-426" satellite. The satellite had a memory device which made it possible to obtain continuous information during the course of the day. This made it possible, as a result of the characteristic orbital inclination to the equatorial plane (74°) and the axis of the earth's rotation to the geomagnetic dipole (11°), in the course of the day to be able to obtain the full pattern of distribution of the electron fluxes for both polar caps. The data were obtained on 6-8 June 1971 under conditions of low magnetic activity. Figure 1 shows regions of registry of electrons with $E_e \simeq 300$ eV and $E_e \simeq 10$ keV. Figure 2 gives the high-latitude boundaries of constantly existing fluxes of electrons with energies > 20, 90 and 250 keV and > 2 MeV. Three curves in the upper part of Fig. 2 give the position of the boundary of the fluxes of electrons in dependence on local geomagnetic time. There are also four curves giving the boundaries of capture for electrons of four different energies. A maximum asymmetry is observed for the boundary of electrons with $E_e > 20$ keV: $\Lambda = 68°$ at 0000 MLT and $\Lambda = 76°$ at 1200 MLT. The boundary of electron fluxes with $E_e > 90$ keV and above approximately corresponds to the boundary of the radiation belts. Electrons with $E_e \simeq 300$ eV penetrate into the magnetosphere from interplanetary space. The region of registry of such electrons lies partially in the region of open lines of force. Their deep penetration into the magnetosphere from the nighttime side $\Lambda \simeq 62$-$65°$ evidently can be attributed to drift in crossed magnetic and electric fields. Electrons with $Ee \simeq 10$ keV are registered in the region of closed lines of force and also in the neutral point region.
[198]

SATELLITE OBSERVATION OF HARD X-RADIATION

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV No 4, 1976, pp 641-645

[Article by L. S. Bratolyubova-Tsulukidze, M. I. Kudryavtsev, A. S. Melioranskiy, I. A. Savenko and B. Yu. Yushkov, "Observation of Discrete Sources of X-Radiation Aboard the 'Kosmos-428' Artificial Earth Satellite"]

[Abstract] The RS-5 x-ray spectrometer is designed for the registry of discrete sources of cosmic x-radiation, determination of their position, intensity and spectral characteristics in the energy range greater than 30 keV. The sensing element is a crystal of CsI(Tl) with a height of 20 mm and a diameter of 80 mm, whose effective area as a result of shading by the collimator is equal to 22.8 cm^2. Figure 1 is a structural diagram of the instrument, whose functioning is discussed fully. The spectrometric characteristics of the instrument are presented. This spectrometer was carried on the "Kosmos-428" satellite, launched on 21 June 1971 into a circumterrestrial circular orbit with an altitude of 250 km. The period of revolution was 91 minutes, orbital inclination was 52° and the orbital axis experienced precession with an azimuthal velocity of 4°.5 per day. The spectrometer was mounted aboard the satellite in such a way that the maximum of the directional diagram was oriented in the zenith and its broad section was situated perpendicular to the satellite flight direction. This paper gives the coordinates of five sources of hard x-radiation -- Cosmos HX, Nos 7, 9, 11, 12, 13. The source HX No 12 could not be identified with sources registered in other experiments. The spectrum of this source can be represented by a power law with an exponent 1.8. Extension of this spectrum into the energy region 2-6 keV gives a flux exceeding by a factor of great magnitude the minimum emission flux registered by the "Uhuru." It can be postulated that the source has a strong variability or that there is a marked decrease in source intensity in the region of soft x-radiation.
[198]

INTERPRETATION OF SATELLITE TV PHOTOGRAPHS IN ANTARCTICA

Leningrad INFORMATSIONNYY BYULLETEN' SOVETSKOY ANTARKTICHESKOY EKSPEDITSII in Russian No 93, 1976, pp 78-80

[Article by E. I. Lutsenko, Arctic and Antarctic Scientific Research Institute, "Peculiarities of Tie-In and Interpretation of Satellite Television Photographs in Antarctica"]

[Abstract] The use of satellite materials during the 15th-17th Soviet Antarctic Expeditions considerably facilitated the analysis of synoptic charts of the southern hemisphere. On the 17th expedition TV satellite information at Molodezhnaya was received from ESSA-8 and NIMBUS-4. The tie-in of ESSA-8 photographs to geographic coordinates was accomplished using the method of imprinting a geographic coordinate grid on each frame and then preparing a photomosaic. The error in such tie-in is 50-60 km (sometimes 100 km). In determining centers of cyclones, fronts, etc. such an error is entirely admissible, but a higher tie-in accuracy is desirable when compiling charts

of ice conditions. Accordingly, the tie-in of photographs was refined on the basis of geographic landmarks. The most reliable and permanent landmarks near Molodezhnaya are rock outcrops and the Prince Charles Mountains, as well as special convolutions of the shore. In the case of NIMBUS-4, the tie-in of TV photographs was on the basis of geographic landmarks along the coast. In the absence of the latter the tie-in of photographs from this satellite was by means of a comparison of the cloud formations on them with the cloud formations on ESSA-8 photographs. On the satellite photomosaics it was not always possible to determine the position of the northern boundary of the zone of drifting ice because clouds and fogs constantly form at the ice-water discontinuity.
[215]

ELECTRON ENERGY SPECTRA OVER SOUTH POLE

Leningrad INFORMATSIONNYY BYULLETEN' SOVETSKOY ANTARKTICHESKOY EKSPEDITSII in Russian No 93, 1976, pp 54-59

[Article by P. G. Astakhov, A. S. Besprozvannaya, L. I. Korovina and T. M. Krupitskaya, Arctic and Antarctic Scientific Research Institute, "Determination of Energy Spectra of Injected Electrons in N(h) Profiles of F2 Layer Over the South Pole"]

[Abstract] This paper gives the results of an analysis of the vertical profiles of electron density in the F region over the Antarctic station Amundsen-Scott at the south pole on the basis of data from vertical sounding of the ionosphere in 1967. The location of the station at the geographic pole creates exceptional possibilities for investigating the effects of interaction between charged particles and the ionosphere during the winter months when the wave source of ionization is completely excluded for a long period. Such investigations are helpful in finding and explaining the sources of maintenance of the winter ionosphere in the polar cap region and under the daytime part of the cusp. Computations were made in the following order. 1. On the basis of experimental N(h) profiles it was possible to compute the rates of ion formation at altitudes from 100 km to the maximum of the F2 layer (q(h) profiles). 2. The q(h) profiles were used to determine the differential energy spectra of precipitating particles causing nighttime ionization. 3. The determined spectra were approximated by an exponential function $I = I_0 E^{\gamma} \exp(-E/E_0)$. All computations were made at the Arctic and Antarctic Scientific Research Institute using a "Minsk-32" electronic computer. Figure 1 shows the profiles of the rates of ion formation computed using ionograms of South Pole station; Figure 2 shows the energy spectra of precipitating electrons in the range 0.15-5 keV, computed using profiles of the rate of ion formation. The investigations indicated the possibility of using data from ground vertical sounding for determining the parameters of geoactive fluxes penetrating into the shaded polar ionosphere.
[215]

SYNTHESIS OF ORGANIC MATTER IN SPACE

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.382

[Abstract of article by Ilczuk Zdzislaw; ASTRONAUTYKA 18, No 5, 1975, pp 10-13, "Synthesis of Organic Matter in Space"]

[Text] This is a discussion of the problems in chemical evolution of matter in the universe from the point of view of generation of different life forms on individual celestial bodies.
[29]

PLANETARY-COSMIC PRINCIPLES OF ORGANIZATION OF LIFE

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.383

[Abstract of article by A. S. Presman; Moscow, KOSMOS I EVOLYUTSIYA ORGANIZMOV, 1974, pp 18-35]

[Text] It is asserted that the solution of the problem of unified fundamentals of life requires a reexamination of the traditional concepts of the essence of life, the sources of its appearance and development. It is proposed that this reexamination be carried out from the point of view of the science of the biosphere. From the author's point of view, the hierarchy of living nature developed, evolved and now functions as a regular part of the planetary cybernetic system -- the biosphere, which in turn was formed and developed as a regular part of the organization of the universe. It assumes the existence of a universal carrier of information in the biosphere and its neighborhood in space and the organization of all levels of the hierarchy in the biosphere in accordance with unified principles. Electromagnetic field are regarded as universal carriers of information in living nature -- from the external medium to organisms, within organisms and between them. Bibliography of 39 items.
[29]

ALGORITHM FOR CORRECTING PROGRAMMED MOTION

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.291

[Abstract of article by M. S. Konstantinov and G. G. Fedotov; Moscow, F. A. TSANDER I SOVREM. KOSMONAVTIKA, "Nauka," 1976, pp 130-137, "Algorithm for Correction of Programmed Motion of a Vehicle with a Low-Thrust Engine"]

[Text] The authors propose a method for reducing the problem of synthesis of the law of correcting control for a spacecraft with an electrojet engine to a conditionally extremal problem. The correcting control is selected in the form of a piecewise-constant function of the phase coordinates of the vehicle. Also examined is the model problem of the perturbed motion of a spacecraft in a force-free field.
[29]

CORRIDORS FOR ENTRY INTO PLANETARY ATMOSPHERES

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.288

[Abstract of article by N. A. Eysmont; Moscow, F. A. TSANDER I SOVREM. KOSMONAVTIKA, "Nauka," 1976, pp 143-148, "Corridors for Entry Into the Atmosphere of a Planet During a Transfer Maneuver from a Hyperbolic Trajectory into the Orbit of a Planetary Satellite"]

[Text] The authors solve problems associated with the selection of optimum control with transfer from a hyperbolic trajectory to the orbit of a planetary satellite. It is assumed that the spacecraft is first braked in the planetary atmosphere by the action of aerodynamic forces and then by means of an engine is put into a stipulated satellite orbit. Also given are the results of computations of the width of the entry corridor illustrating the effectiveness of optimum control when there is a restriction on the sum of the necessary rocket dynamic velocity impulses. Bibliography of eight items.
[29]

SATELLITE OBSERVATIONS OF MAGNETIC SUBSTORM

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.182

[Abstract of article by L. V. Strunnikova; Moscow, SOLNECHN. VETER I GEOMAGNIT. VOZMUSHCHENIYA, 1975, pp 57-70, "Magnetic Substorm of 4 March 1970 According to Data from the 'Kosmos-321' Satellite"]

[Text] On the basis of data from magnetic measurements on the AES "Kosmos-321" a study was made of a substorm not complicated by the presence of a well-developed exoionospheric ring current. The article gives a comparison with data from the AES OGO 6. The pattern of the disturbance is determined on the basis of satellite and ground data. All the effects of the T disturbance on the satellite are attributed to the influence of ionospheric electrojets. Bibliography of seven items.
[29]

SOLAR WIND AND POLAR REGION VARIATIONS

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTAVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.181

[Abstract of article by R. F. Afonina, B. A. Belov, A. Ye. Levitan and Ya. I. Fel'dshteyn; Moscow, MEZHPLANET. MAGNIT. POLYA I GEOFIZ. YAVLENIYA V VYSOKIKH SHIROTAKH, 1975, pp 95-112, 128, "Some Aspects of the Correlation Between the Magnetic and Electric Fields of the Solar Wind and Variations in the Near-Polar Region"]

[Text] For a year of the solar activity cycle maximum (1968) the authors have derived linear regression equations and the correlation coefficients (r) between the values of the vertical component of the geomagnetic field Z and the azimuthal component B_y of the interplanetary magnetic field (IMF). A study was made of the representation of B_y of the IMF in different coordinate systems on the r value and the dependence of r on the time shift Δt between field measurements on a satellite and at the earth's surface. Bibliography of 16 items.
[29]

FIELD OF MAGNETIC VARIATIONS IN POLAR REGIONS

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.180

[Abstract of article by Ya. I. Fel'dshteyn; Moscow, MEZHPLANET. MAGNIT. POLYA I GEOFIZ. YAVLENIYA V VYSOKIKH SHIROTAKH, 1975, pp 3-94, 127, "The Structure of the Field of Magnetic Variations in the Near-Polar Region in Relation to the Interplanetary Magnetic Fields"]

[Text] This is a review of the results of an analysis of geomagnetic variations in the near-polar region obtained during the last four years with the direct participation of the author. Particular attention is devoted to the correlation between these variations and the components of the interplanetary magnetic field (IMF). The authors have found the quantitative relationships between the intensity of near-polar variations and the azimuthal component B_y of the IMF, on the basis of which a method is proposed for diagnosis of B_y of the IMF on the basis of ground observations. It was possible to refine existing concepts concerning the structure of the field of magnetic variations in the near-polar region. Bibliography of 90 items.
[29]

PANORAMIC SURVEY OF MARS

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.106

[Abstract of article by A. S. Selivanov, V. M. Govorov, V. P. Chemodanov, M. K. Narayeva and M. V. Gitlits; Moscow, TEKHNIKA KINO I TELEVIDENIYA, No 1, 1976, pp 35-37, "Panoramic Survey of Mars"]

[Text] The article describes the panoramic survey of Mars made in 1974 from the automatic interplanetary stations "Mars-4" and "Mars-5." The survey was made using single-line optical-mechanical scanning devices with an angle of view of 30° and a scanning rate of four lines per second, sensitive in the ranges 0.55-0.75, 0.6-0.85 and 0.6-1.1μm. The videoregistry of signals aboard the vehicle was on a memory device using a magnetic tape. [29]

DEVICE FOR MEASURING CHARGED PARTICLES

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.108

[Abstract of patent issued to A. V. Bogdanov, O. L. Vaysberg, B. V. Polenov, B. I. Khazanov and A. A. Zertsalov; Moscow, Author's Certificate No 351465 (No 1604117), published 14 June 1975, "Device for Measuring Fluxes of Charged Particles"]

[Text] The authors propose a system for the control of a multilayer electrostatic analyzer which ensures instrument operation in two regimes: in a regime for finding the energy range and in a regime for measuring the spectrum. Beginning operation in a search regime, when the instrument successively passes through the energy subranges from E_{max}, the system, on the basis of signals from the threshold device connected to the outputs of the detectors, itself selects the energy subrange in which the detector signal exceeds the background by a factor of 5-10. In addition, with the presence of a maximum in the measured spectrum the system ensures the parallelism of all the analyzers for the purpose of increasing response. The device makes it possible to reduce the time required for measuring the spectrum by eliminating the energy zones where intensity is low. Reverse connection into the search regime is accomplished by a command from the programming device. [29]

ISSUE OF "SUN-EARTH" BULLETIN

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.59

[Abstract of periodical IZVESTIYA SOVETA "SOLNTSE-ZEMLYA"; Moscow, USSR Academy of Sciences, No 11, 1976, 42 pages]

[Text] This bulletin gives brief information on international and intra-union measures in the field of solar-terrestrial physics, recommendations, resolutions and program documents adopted in the course of these measures and also complex programs and experiments planned and carried out in the field of solar-terrestrial physics.
[29]

IMPOSSIBILITY OF LIFE ON VENUS

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian, No 7, 1976, 7.62.83]

[Abstract of article by Albert Ducrocq; Paris, AIR ET COSMOS in French, No 601, 1975, pp 46-48, "Impossibility of Life on Venus"]

[Text] The process of exploration of the planet by means of the spacecraft "Venera-9" and "Venera-10" is briefly considered. Also enumerated are the principal Soviet scientific centers responsible for communication, control of vehicles, and processing the information collected from them. The author discusses the peculiarities of design of spacecraft used in investigating Venus and its atmosphere. On the basis of available data and data received from the descent modules it is postulated that life cannot exist on Venus.
[29]

MODELING PROCESSES IN PLANETARY ATMOSPHERES

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.103

[Abstract of article by G. I. Petrov, I. M. Yavorskaya, Yu. N. Belyayev, A. A. Monakhov, I. I. Slezinger, A. A. Goryainov and V. I. Fuks; Moscow, MODELIROVANIYE DINAMICHESKIKH PROTSESSOV V ATMOSFERAKH PLANET. CH. I. USTANOVKA DLYA IZUCHENIYA USTOYCHIVOSTI SDVIGOVYKH TECHENIY V SFERICHESKIKH SLOYAKH. PREDVARITEL'NYYE REZUL'TATY (Modeling of Dynamic Processes in Planetary Atmospheres. Part I. Apparatus for Study of the Stability of Shear Currents

in Spherical Layers. Preliminary Results), Space Research Institute USSR Academy of Sciences, Preprint 255, 1975, 39 pages]

[Text] The article describes an experimental apparatus designed for study of shear currents in rotating spherical layers for the purpose of clarifying the possibilities of modeling of large-scale dynamic phenomena in the atmospheres of the planets and the earth. The paper gives the preliminary results of an investigation of the developing currents and their stability with different values of the similarity parameters. Bibliography of 18 items.
[29]

SATELLITE MOTION IN NONINERTIAL COORDINATE SYSTEM

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEVODANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.256

[Abstract of article by V. P. Semenko; Moscow, F. A. TSANDER I SOVREM. KOSMONAVTIKA, "Nauka," 1976, pp 154-161, "Satellite Motion in a Noninertial Coordinate System"]

[Text] The author has derived the equations of perturbed motion of an AES in a coordinate system rotating in a special way. The coordinate system is such that the motion of the AES in it in the case of arbitrary forces is central. The derived system of equations is compact, without singularities and degenerations and all the variables have a simple geometric sense. Expressions are derived which relate the variables of the derived equations and the position and velocity of the AES in a fixed Cartesian coordinate system. Bibliography of five items.
[29]

OPTIMIZATION OF FLIGHTS FROM ORBITS OF ARTIFICIAL LUNAR SATELLITES

Moscow REFERATIVNYY ZHURNAL, 62. ISSLEDOVANIYE KOSMICHESKOGO PROSTRANSTVA, OTDEL'NYY VYPUSK in Russian No 7, 1976, 7.62.284

[Abstract of article by L. I. Gusev; Leningrad, UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA, 6, No 6, 1975, pp 124-129, "Optimization of Flights from the Orbits of Artificial Lunar Satellites and Back in the Case of a Fixed Orbital Plane of Artificial Lunar Satellites"]

[Text] A study was made of the method for computing the characteristic velocities of two-impulse flights between the circular orbits of artificial earth satellites and artificial lunar satellites for the case of a fixed orbital plane of an artificial lunar satellite. It was possible to find

the orientation of the plane of a selenocentric hyperbola forming the minimum angle φ_{min} with the stipulated orbit of an artificial lunar satellite both during flight from the earth to the moon and during return from the moon to the earth. The proposed method uses the results obtained in a solution of the problem in a precise formulation and ensures computation of the total characteristic velocity with an error less than ±15 m/sec without solution of the boundary value problem. Bibliography of six items. [29]

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