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20 July 1978

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 425

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

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	CONTENTS	PAGE
I.	ASTRONOMY.....	1
	News.....	1
	Artemovskiy Neutrino Telescope.....	1
	Abstracts of Scientific Articles.....	4
	Sneg-3 and Gamma Astronomy.....	4
	Radiophysical Studies of Venus from Spacecraft.....	4
II.	METEOROLOGY.....	6
	News.....	6
	Optical Detector Monitors Air Pollution.....	7
	Abstracts of Scientific Articles.....	7
	Extremal Properties of Climate Models.....	7
	Effect of Variation of Earth's Orbital Parameters on its Insolation.....	7

	<u>Page</u>
Parameterization of Interaction Between Atmosphere and Ocean....	8
Laser Spectrometer Used for Large Condensation Nuclei.....	8
III. OCEANOGRAPHY.....	10
News.....	10
Submersible Carried on Board New Research Ship "Gidronavt".....	10
New Series of Submersibles Developed.....	11
Abstracts of Scientific Articles.....	13
Strontium-90 and Tritium in Surface Waters of Pacific.....	13
Wave Turbulence in the Beta Plane.....	14
Fluctuations of Vertical Current Velocity Gradients in Tunis Strait.....	14
Temperature Fluctuations in Upper Layer of Sea.....	15
Role of HF Gravitational Waves in Aerodynamic Resistance of Sea Surface.....	15
Special Case of Numerical Modeling of Currents.....	15
IV. TERRESTRIAL GEOPHYSICS.....	17
Abstracts of Scientific Articles.....	17
Process of Focal Development of World's Strongest Earthquakes..	17
Absorption of Longitudinal Waves in Earth's Upper Mantle.....	17
Subtraction of Predicted Fields of Multiple Seismic Waves.....	18
V. UPPER ATMOSPHERE AND SPACE RESEARCH.....	19
News.....	19
Articles Discuss Soviet Work in Space, Hungarian Contributions.	19
TASS Announces Launching of "Kosmos-1010	26
TASS Announces Launching of "Kosmos-1012".....	26
TASS Announces Launching of "Molniya-1" Commo Satellite.....	27

	<u>Page</u>
TASS Reports on End of COSPAR Session.....	27
TASS Announces Launching of "Kosmos-1022".....	28
TASS Announces Launching of Eight "Kosmos" Satellites.....	29
Georgiy Grechko Advises "Soyuz-29" Cosmonauts.....	29
TASS Announces Plans for Launch of India's Second Satellite.....	32
Medical and Metallurgical Experiments in Space Described..	32
Abstracts of Scientific Articles.....	34
Effects Exerted on the Ozonosphere by Different Substances	34
VI. MISCELLANEOUS.....	34
News.....	35
"Kosmos-1000" Aids Orientation of Icebreaker "Sibir".....	35
Heavy Ice Impedes Movement Along Northern Sea Route.....	36
Work of Soviet Glaciologists Reviewed.....	36
Kapitan Myshevskiy Led Into Open Waters.....	38
Arctic Convoy Alters Course.....	38
Icebreaker "Sibir" Reaches Polar Drifting Station.....	39

I. ASTRONOMY

News

ARTEMOVSKIY NEUTRINO TELESCOPE

Kiev PRAVDA UKRAINY in Russian 9 Jun 78 p 4

[Article by V. Popov: "Space Patrol from a Mine"]

[Text] Along the road from Donetsk to Karlo-Libknekhtovsk, a village of salt miners, I tried to visualize what the apparatus of the Institute of Nuclear Research USSR Academy of Sciences situated there in one of the mines would look like. I knew that it was designed for "neutrino scanning" of the universe, especially during the periods of the most grandiose cataclysms -- flares of supernovae.

And here I am in the mine. In the sparkling half-darkness of the enormous grotto, chiseled in the salt stratum, the contours and dimensions of the neutrino telescope were somewhat obscured. The engineer A. Chudin and scientific specialist R. Yenikev began to familiarize me with the instrument.

As in any telescope, in this unique structure there is an "eye." Its role is played by a scintillation detector -- a hollow cylinder of stainless steel with a volume of 120 cubic meters. It is filled with 100 tons of scintillator -- a fluid which glows if a charged particle enters it. The tiny cylinders of the photomultipliers situated on the walls of the detector transform this glow into an electric impulse. Then the signal is fed along a cable to the "brain" of the apparatus -- an electronic registry system. "Flying" into the telescope, the particle on its path is registered by 144 photomultipliers in whose field of view enter the light flashes from its interaction with the scintillator. And in the electronic "brain" the information is summed, sampled and "stored."

The apparatus is designed primarily for observation of collapses. Exhausting its nuclear "fuel," the celestial body under the influence of gravitational forces is compressed without limit into neutron stars or even into "black holes" where the gravitational forces become so great that no radiation can

be emitted. During the time of collapse in several seconds a powerful flux of neutrinos is ejected into space, in total energy exceeding by millions of times the ordinary radiation of the entire Galaxy during this time. Intercepting this flux, scientists will learn much about what is transpiring in the interiors of the dying stars.

A neutrino is a highly surprising particle having an enormous penetrating power. Entire "avalanches" of particles tumble onto the earth and under ordinary conditions it is impossible to isolate neutrinos from them. In order to isolate neutrinos, for example, from the "background" of mu mesons -- the most penetrating of its companions -- there must be at least a 30-km air layer or a shaft with a depth of 5 kilometers!

Academician M. Markov proposed the registry of neutrinos arriving from the other side of the earth; in such a case the earth's thickness is known to hold back all the other particles. The site for the central neutrino station was selected in the Northern Caucasus, the Baksanskoye Canyon, in the depths of Mount Andyrchi. However, physicists installed the second telescope in an underground mine of the "Artemsol" Production Combine, which is in Artemovskiy Rayon in Donetskaya Oblast.

The 240 meters of rock reliably cover the 100-ton detector of the "underground variant" against the penetration of most cosmic particles. And the salt layer -- substance of low radioactivity -- serves as a singular barrier against the natural radiation of such elements as uranium or thorium. Due to shielding virtually only mu-mesons enter the telescope (these are particles similar to an electron, but 206 times heavier), and also different species of neutrinos and antineutrinos. But their number is enormous: before my eyes in the course of five seconds there was registry of several thousand flashes. The particles necessary to researchers are determined from the so-called energy interval.

There is a broad range of problems which the scintillation telescope helps to solve. For example, it is possible to determine the sectors of the universe from which cosmic rays of a very high energy reach us, surpassing by many times those energies to which particles can be accelerated by terrestrial accelerators. Or to clarify such matters exciting to scientists as: do neutrinos of one type undergo transition into other types? do they have a mass?

"The exceptional importance of neutrino apparatus," says the director of the Artemovskaya Station, who heads the Sector at the Institute of Nuclear Research, Candidate of Physical and Mathematical Sciences O. Ryazhskaya, "is that using them it is possible to obtain fundamentally new information concerning the universe. Experimental neutrino astrophysics affords a unique possibility for studying the processes transpiring in the interiors of stars in the case of a superdense state of matter. In addition, scintillation telescopes are not only astrophysical instruments, but also physical instruments. Using them our institute hopes to solve a whole

series of problems in the physics of elementary particles and cosmic rays..."

The two Soviet neutrino apparatuses are becoming part of the World Service for Monitoring Flares of Supernovae. Still another (and our specialists are participating in its outfitting) will operate in Italy, in a tunnel beneath famed Mont Blanc. American researchers are placing their instrument in a gold mine in the Dakotas. A study is being made of the possibility of constructing a neutrino telescope in India.

The new direction is opening broad horizons before science. What information do neutrinos carry? What space news do they bring? The future will give an answer to these questions.

[435]

Abstracts of Scientific Articles

SNEG-3 AND GAMMA ASTRONOMY

Moscow ZEMLYA I VSELENNAYA in Russian No 3, 1978 pp 44-47

[Article by S. V. Petrunin and G. I. Kharitonov]

[Abstract] The data to be obtained on the diffuse background of gamma radiation, discrete sources of x-rays and gamma radiation and gamma flashes of cosmic origin by the joint Soviet and French experiments using the Sneg-3 [Snow-3] artificial earth satellite are discussed. A general outline of the history of the joint project and gamma astronomy and its goals is presented. The researchers expect to study the diffuse background gamma radiation in the range 20 KeV to 10 MeV by measuring the intensity and the spectrum of gamma quanta of the diffuse background, and the possible anisotropy of the background gamma radiation, the discrete sources of x- and gamma radiation to energies of 1 to 2 MeV by measuring the intensity and energy spectrum of the sources and identifying the processes of their formation, and the gamma flashes of cosmic origin. An orbit of 500 km with 51 degrees of inclination was selected in order to meet the two requirements of the longest possible time for working with the satellite and prevention of it from intersecting the radiation belts. The special adapter for attaching the satellite to the last stage of the booster rocket built at the CNES center in Toulouse to protect the satellites from vibration and measures taken to decrease the heat flux to the satellites in transit are noted.

[437]

RADIOPHYSICAL STUDIES OF VENUS FROM SPACECRAFT

Moscow ZEMLYA I VSELENNAYA in Russian No 3, 1978 pp 33-37

[Article by Professor M. A. Kolosov and Doctor of Technical Sciences O. I. Yakovlev]

[Abstract] A brief discussion is presented on the radiophysical studies of the atmosphere and relief of Venus and the plasma in the neighborhood of the sun from the "Venera-9" and "Venera-10" automatic interplanetary stations.

Three radiophysical experiments were carried out on the basis of the effect of the environment on radio wave parameters. The methods of radio wavelength transillumination and radio wave reflection were used to study the upper part of the Venusian atmosphere in the altitude range from 40 to 500 km and to obtain information about the relief and pressure variation at the surface as a function of the relief respectively. The escape velocity of plasma from the sun and the turbulence of the plasma near the sun were studied by transillumination. Graphs are presented for the electron concentration of the atmosphere as a function of altitude, radio wave amplitude as a function of time for the troposphere and ionosphere of Venus and temperature as a function of altitude for the nighttime and daytime sides of the planet. The pressure at an altitude of 40 km was 3.5 atmospheres and at an altitude of 51 km it was 1 atmosphere. Venus has broad plains with leveled relief and mountainous areas. The mechanism of wind formation in the Venusian atmosphere was established on the basis of the temperature distribution such as the high winds and turbulence at an altitude of 65 km where there are large temperature differences between the nighttime and daytime sides. The studies of the plasma near the sun showed that the velocity of the solar wind increases with an increase in the distance to the center of the sun. The solar wind formation mechanism is analyzed on the basis of measurements of solar wind velocity and the degree of plasma turbulence.

[437]

II. METEOROLOGY

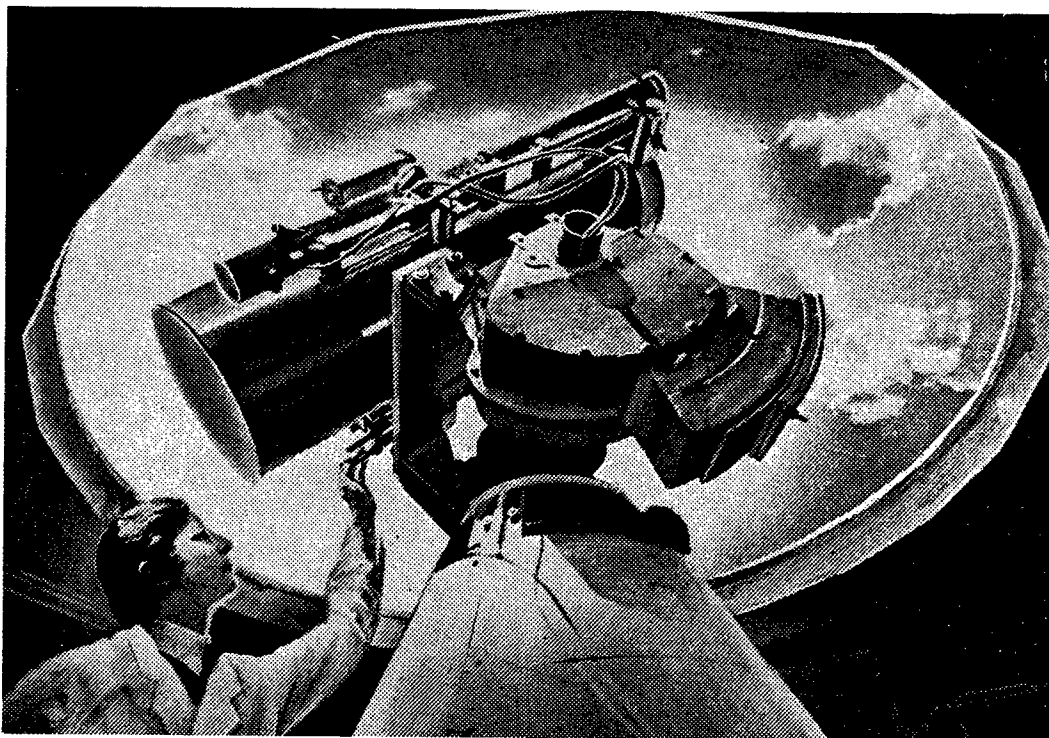
News

OPTICAL DETECTOR MONITORS AIR POLLUTION

Moscow PRAVDA in Russian 19 May 78 p 6

[Photo caption: "Guard of Clean Air"]

[Summary] A meteorological optical detector has been made at the USSR Academy of Sciences' Siberian Division Institute of Optics of the Atmosphere in Tomsk. Capable of detecting even insignificant amounts of dust and smoke at altitudes of 3-4 kilometers, the device is valuable in monitoring air pollution in industrial areas.



[416]

Abstracts of Scientific Articles

EXTREMAL PROPERTIES OF CLIMATE MODELS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 4, 1978 pp 378-387

[Article by G. S. Golitsyn and I. I. Mokhov, Institute of Atmospheric Physics, "Stability and Extremal Properties of Climate Models"]

[Abstract] On the basis of the nonequilibrium thermodynamics of irreversible processes the authors point out the conditions related to the stability of the system in which there can be a minimum of the rate of exchange of entropy with the external medium. Such a principle was introduced into the semi-empirical Paltridge model, which sufficiently well describes present-day climate. It is shown that a minimum of the rate of exchange of entropy with the external medium also exists in other simple climate models, in particular, in the models formulated by Budyko and North. However, for these this minimum corresponds to a sharper change in temperature with latitude than is actually the case. The authors discuss the reasons for such a discrepancy. These can be related both to a possible modification of the principle itself and to an inadequately successful parameterization of radiation or failure to take into account some factors in the models. It is noted that it is desirable to seek such extremal properties in large numerical models of general circulation and climate and some recommendations along these lines are given.

[411]

EFFECT OF VARIATION OF EARTH'S ORBITAL ELEMENTS ON ITS INSOLATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 4, 1978 pp 388-395

[Article by N. I. Burangulov and N. A. Petrov, Institute of Oceanology, "Influence of Periodic Variations of Earth's Orbital Elements on its Insolation"]

[Abstract] This article consists of five parts: 1. The Earth's Climate as a Function of Astronomical Parameters. 2. Estimates of Variations of Insolation. 3. Secular Perturbations of Elements ε , h , e and J . 4. Periodic Perturbations of Elements ε , h , e and J . 5. Comparison of Secular and Periodic Variations of Insolation. On the basis of these analyses the authors have computed the periods and amplitudes of the periodic perturbations of the earth's orbital elements caused by the gravitational effect of Jupiter, Venus, Mars and the Moon. These perturbations are compared with the secular perturbations of the elements. It is shown that the latter exceed by two to four orders of magnitude the periodic perturbations and therefore the corresponding changes in insolation can scarcely have an appreciable effect on the earth's insolation.

[411]

PARAMETERIZATION OF INTERACTION BETWEEN ATMOSPHERE AND OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 14, No 5, 1978 pp 510-519

[Article by Ye. P. Borisenkov and M. A. Kuznetsov, Main Geophysical Observatory, "Parameterization of Interaction Between the Atmosphere and Ocean Under Stormy Weather Conditions Applicable to Models of General Circulation of the Atmosphere"]

[Abstract] The article sets forth a physical model of heat and moisture exchange between the atmosphere and ocean in the presence of moderate and strong winds. The authors propose a method for the parameterization of this interaction applicable to models of general circulation of the atmosphere requiring insignificant expenditures of processing time. On the basis of the numerical experiments carried out, the article gives estimates of the fluxes of heat and moisture in dependence on the parameters of the problem, revealing a considerable contribution of the processes of interaction between the atmosphere and ocean by means of spray clouds (during a storm) to the total balance of the ocean-atmosphere system.

[434]

LASER SPECTROMETER USED FOR LARGE CONDENSATION NUCLEI

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 14, No 5, 1978 pp 520-526

[Article by Yu. V. Zhulanov, I. V. Petryanov and B. F. Sadovskiy, Physico-chemical Scientific Research Institute, "Laser Photoelectric Spectrometer for Measuring Large Condensation Nuclei"]

[Abstract] The article gives a description of a photoelectric spectrometer used in measuring aerosol particles, improvement of its response and other parameters, achieved by using as the light source a continuous action He-Ne laser. The high response and resolution of the laser aerosol spectrometer, despite the smallness of the sensitive volume, makes it possible to carry out measurements of the concentration and dispersivity of large nuclei without dilution and with a high accuracy. The instrument response is $0.1\mu\text{m}$ in radius and the maximum concentration measured without dilution is $2 \cdot 10^4 \text{ cm}^{-3}$. The paper gives experimental data on dispersivity of atmospheric aerosols confirming the data obtained by other authors.

[434]

III. OCEANOGRAPHY

News

SUBMERSIBLE CARRIED ON BOARD NEW RESEARCH SHIP "GIDRONAVT"

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 May 78 p 4

[Unsigned article]

[Text] The search for commercial concentrations of fish, the study of conditions in different ocean areas and the testing of new fishing gear, the reproduction of fish reserves and the preservation of the environment -- such is by no means a complete list of the problems in whose solution the new scientific ship "Gidronavt" is participating. Today this vessel is undergoing tests in the Black Sea. Its design and equipment are described by N. A. Yakshin, chief of the design bureau:

"The 'Gidronavt' fish reconnaissance vessel is a sort of floating laboratory. The ship is small: length -- 53.7 m, width -- 10.5 m, height of sides -- 6 m, displacement -- 1,260 tons. But despite this, the 'Gidronavt' is outfitted with everything necessary for carrying out reconnaissance work."

"In the detection of concentrations of fish at distances up to 3,000 m and at great depths researchers are being aided by a special hydroacoustic complex. The apparatus for hydrological investigations makes it possible to obtain all data on the state of the atmosphere and water medium. And the stern apparatus can be used for both bottom trawls and trawling at different depths. But, to be sure, the most important aid for researchers is a submersible self-propelled deep-water vehicle."

"On the way to the search region the submersible will be in a special hold. For its submergence into the water provision is made for an original lowering-raising complex making it possible to extract the vehicle from the hold and set it on board literally within a few minutes. This operation can be performed when there are waves at sea up to 4 scale units. And the raising of the vehicle aboard the ship is possible with waves up to 5 scale units. In particular, for this purpose the ship is outfitted with an "antilisting" system. Taking into account that during the time of free search the submersible in its motion can withdraw from the ship for a considerable distance,

in its development particular attention was devoted to different communication systems and instruments."

"The principal power plant of the 'Gidronavt' is a diesel engine with a power of 1,320 HP. At full speed it ensures movement at up to 12.3 knots and supplies the ship with electric power. For better maneuverability at the stern and prow there are control devices of the 'screw in a pipe' type which enable the ship to move by a log, turn in place and despite the wind and waves, to stay precisely in position."

[428]

NEW SERIES OF SUBMERSIBLES DEVELOPED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Apr 78 p 4

[Article by O. Popov: "Robots Inhabit the Depths"]

[Text] From a distance this looked really strange: steep-browed, similar to a dirigible, the ship slowly crept from the waters of Golubaya Bay and floated along the pebble-strewn shore under the arch of an enormous hangar. With unblinking glance of the window-eye, it resembled a steel octopus with two outspread tentacles. And even close up, seeing the wheeled carrier and rails beneath the ship, as well as the thick cable, the line by which a powerful electric winch drew it into the hangar, the viewer could not immediately comprehend that he was standing alongside the unknown...

This underwater dirigible-ship has just risen from the depths of the Black Sea, several hundred meters. The aquanauts Nikolay Gribtsov, Yuriy Belyayev and Anatoliy Sidorov have carefully inspected their "Argus" for water tightness and were satisfied. Not a single drop of water had penetrated within the new "Nautilus" of science.

"This was a purely technical dive," said the chief of the Laboratory of Underwater Research Vladlen Petrovich Nikolayev. "Now we are preparing the 'Argus' for scientific research. The 'stuffing' of the vehicle is very important -- the most modern highly sensitive apparatus, excellent hydrooptical systems, a strong television camera. Two electric motors enable the 'Argus' to develop an underwater speed up to three knots: this is entirely adequate for the performance of research work. The 'Argus' can remain at the bottom for three days, although the energy reserve in its storage batteries, breathing mixture for a crew of three men, food and water are intended for a longer time. But this is just an emergency precaution which we hope will never have to be taken advantage of. The ship does not weigh a great deal -- only 10 tons. Therefore, the carrier ship can easily deliver it to any region in the world ocean. And the 'Argus' can be used for other purposes than as a scientific explorer of the depths. Its crew is capable of carrying out the function of a dispatcher, a sort of superintendent of underwater work which will be performed here by aquarobots," and my companion points his finger to the steel octopus.

"This is a second-generation 'Skat' robot. Its 'brain' is an electronic computer which receives commands by radio and after performing them is capable of collecting and processing information far more rapidly than man can do this. Using its manipulator-tentacles, the 'Skat' can collect fragments of solid rocks, suck in unconsolidated samples and plankton, algae and small fish. In addition to this, its 'arms' are capable of performing some repair work, let's say for underwater drilling or work on telephone cable lines. The motors for the four 'Skat' screws, all its mechanisms and instruments, are fed from 4-5-KW electric batteries. But in case of necessity it can receive electric power also through an electric cable from a surface carrying ship. The 'Skat' is also outfitted with powerful searchlights, scanning television camera, photocells, different kinds of navigational and scientific instrumentation."

By beginning with the "Skat," Nikolayev had the objective of surprising us. And he showed us still another robot-diver -- the "Manta-1500." To be sure, this vehicle is not very similar to a real skate [manta] (and I chanced to see a gigantic skate in the South Atlantic). The "Manta" of Golubaya Bay instead more resembles a lunokhod for which the wheeled chassis has been replaced by inflated water skis. Otherwise, especially with respect to its tasks, it is actually similar to a lunokhod. But it is not to supply man with information from the surface of an earth satellite, but from the depths of the ocean. Now the designers of the Section on Technology of Underwater Research of the Institute of Oceanology USSR Academy of Sciences imeni P. Shirshov are working on another "Manta" -- it will help to penetrate even into the craters of ocean volcanoes...

Robots are hurrying to the assistance of man, who is daring to study and conquer the aquaworld...

[427]

Abstracts of Scientific Articles

STRONTIUM-90 AND TRITIUM IN SURFACE WATERS OF PACIFIC

Moscow OKEANOLOGIYA in Russian Vol 18, No 2, 1978 pp 244-247

[Article by S. M. Vakulovskiy, A. I. Vorontsov, I. Yu. Katrich, I. A. Koloskov, Ye. I. Roslyy and V. B. Chumichev, "Strontium-90 and Tritium in the Surface Waters of the North Pacific Ocean in 1974"]

[Abstract] In investigations of the state of radioactive contamination of waters of the seas and oceans during March-June 1974 on the 32d voyage of the research vessel "A. I. Voyeykov" a study was made of radioactive contamination of the surface waters of the North Pacific Ocean. During the voyage 60 water samples were taken (each of 10 liters) for determining the content of strontium-90 and 62 samples (each of 3 liters) were taken for determining the tritium content. The experimental data made it possible to ascertain some peculiarities of the distribution of the concentrations of strontium-90 and tritium in the North Pacific. First it was found that the ratio of the concentrations of tritium/strontium-90 varies in the range from 90 to 600, if one excludes from consideration a point situated near the mouth of the Columbia River at which this value attains close to 2000. Such a broad scatter of values of the ratio of concentrations indicates that the spatial distribution of strontium-90 in the surface waters of the Pacific Ocean does not coincide with the spatial distribution of tritium. Second, there is a tendency to an increase in the concentration of tritium and the ratio of tritium/strontium-90 with approach to the continent. There is a relatively uniform distribution of Sr^{90} in the surface waters with a mean value about 0.15 pcurie/liter. Comparison with data for preceding years shows that the Sr^{90} content in the surface waters decreases with time. For example, in the surface waters to the east of the Japanese Islands to 150°E the concentration during 1966-1968 was 0.25 pcurie/liter, and in 1974 it had decreased to 0.16 pcurie/liter. During the period 1961-1974 the tritium concentration also decreased by a factor of 1.5-2.

[410]

WAVE TURBULENCE IN THE BETA PLANE

Moscow OKEANOLOGIYA in Russian Vol 18, No 2, 1978 pp 192-195

[Article by Ye. N. Pelinovskiy, Institute of Applied Geophysics, "Wave Turbulence in the Beta Plane"]

[Abstract] The author has found the spectra of weak turbulence for divergentless barotropic Rossby waves in the inertial interval corresponding to a constant energy flux, $E(k) \sim k^{-5/2}$, momentum flux, $E(k) \sim k^{-3}$ and enstrophy flux, $E(k) \sim k^{-7/2}$. There is a discussion of the conditions for realization of the spectra of weak turbulence and their joining with the spectra of strong turbulence. It is shown that in the space of wave numbers weak turbulence is realized in the region of small k , and strong turbulence is observed in the region of large k , whereas in frequency space, on the other hand, waves with large ω are slightly turbulent, whereas waves with small ω are highly turbulent.

[410]

FLUCTUATIONS OF VERTICAL CURRENT VELOCITY GRADIENTS IN TUNIS STRAIT

Moscow OKEANOLOGIYA in Russian Vol 18, No 2, 1978 pp 226-232

[Article by V. D. Pozdynin, Institute of Oceanology, "Statistical Characteristics of Stratification of Turbulence and Fluctuations of Vertical Gradients of Current Velocity in the Tunis Strait Region"]

[Abstract] During the 18th voyage of the scientific research vessel "Akademik Kurchatov" (March-May 1974) in the Tunis Strait region specialists carried out measurements of turbulence by the vertical sounding method. In processing the measurements there was found to be an intermittence of the intensity of turbulence with depth. For the region of these investigations the article gives a refined summary of the parameters of the distribution law for the thicknesses of layers with the turbulence levels characteristic for them. Indirect data are used in computing the difference in the vertical current velocity gradients in these layers. The combination of all the differences in gradients is described by a hyperbolic distribution law. In the case of identical vertical density gradients for the water in adjacent layers it is possible to observe different turbulence levels in them which can be attributed to fluctuations of the vertical gradients of current velocity.

[410]

TEMPERATURE FLUCTUATIONS IN UPPER LAYER OF SEA

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 14, No 4, 1978 pp 412-421

[Article by G. N. Khristoforov and A. S. Zapevalov, Marine Geophysical Institute Ukrainian Academy of Sciences, "Wave Components of Spectrum of Temperature Fluctuations in the Upper Layer of the Sea"]

[Abstract] A study was made of the results of experimental investigations of the field of temperature fluctuations in the upper layer of the sea when there are wind waves on the surface. It is shown that the spectra of temperature fluctuations, discriminated by means of linear filtering from the total spectra $S_T(\omega)$, can be described within the framework of a simple model which includes wave movements and a local mean temperature gradient. The article is accompanied by expressions giving the relationship between the integral and spectral parameters of the model and also the values of these parameters on the basis of observational data. The behavior of the spectrum of temperature fluctuations in the region of high frequencies $\omega > 2\omega_0$ is dependent on the state of the sea surface. During a storm there can be predominance of turbulent processes for which the spectra are close to $\omega^{-5/3}$; under calm conditions the influence of microstructure can lead to spectra in the form ω^{-2} .

[411]

ROLE OF HF GRAVITATIONAL WAVES IN AERODYNAMIC RESISTANCE OF SEA SURFACE

Moscow OKEANOLOGIYA in Russian Vol 18, No 2, 1978 pp 203-207

[Article by O. A. Kuznetsov, Institute of Oceanology, "Role of High-Frequency Gravitational Waves in the Aerodynamic Resistance of the Sea Surface"]

[Abstract] On the basis of data from a field experiment in the Caspian Sea the author demonstrates a close correlation between dynamic wind velocity and the mean square values of rises of the sea surface measured in the frequency range 1-10 Hz. It is shown that the Reynolds roughness numbers, computed using the mean square values of high-frequency gravitational waves as the characteristic height of the roughnesses, have the maximum values during a period of active wave development and then sharply decrease.

[410]

SPECIAL CASE OF NUMERICAL MODELING OF CURRENTS

Moscow OKEANOLOGIYA in Russian Vol 18, No 2, 1978 pp 196-202

[Article by D. G. Seidov and Ye. V. Semenov, Institute of Oceanology, "Numerical Modeling of Currents Excited by Fluxes of Heat and Momentum Through the Ocean Surface"]

[Abstract] The article gives a discussion of the results of computations of currents in an ocean with an idealized geometry and a flat bottom. A recently proposed Euler-Lagrange numerical model of ocean circulation is used for this purpose. Emphasis is on the essential three-dimensionality of the circulation. The important role of the wind is demonstrated not in the horizontal, but in the vertical circulation and in the formation of boundary temperature layers leading to jetlike shear currents. Thus, the model presented earlier (D. G. Seidov, IZV. AN SSSR, FIZ. ATMOSFERY I OKEANA, 12, No 10, 1976) is effective in describing advection processes because the results obtained using it do not reveal a strong smoothing of the solution usual for traditional Euler methods for approximating non-linear equations containing multiple averagings over the areas of the grid in a Euler difference grid. Vertical and horizontal heat advection are responsible for the thermal and dynamic regime in the coastal zone, whereas in the central regions of the ocean the horizontal advection of heat is dominant, and this leads to an intensification of the currents.

[410]

IV. TERRESTRIAL GEOPHYSICS

Abstracts of Scientific Articles

PROCESS OF FOCAL DEVELOPMENT OF WORLD'S STRONGEST EARTHQUAKES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 4, 1978
pp 3-16

[Article by A. V. Vvedenskaya and N. V. Golubeva, Institute of Physics of the Earth, "Peculiarities of the Process of Focal Development of the World's Largest Earthquakes"]

[Abstract] An investigation of the mechanism of development of the foci of earthquakes with $M \geq 7.5$, registered by long-period, wide-band instruments at the seismic stations of the USSR, was carried out on the basis of seismograms of body waves. A determination of the duration of the process and the peculiarities of the rate of focal development indicated that this process for the strongest earthquakes is a phenomenon affecting the earth's mantle. It develops in areas which according to the condition of a minimum of potential energy approach a circular form. In each case the focal process transpires discontinuously. Two processes separated in time are manifested which are nonequivalent with respect to the density of the liberated energy: a process transpiring virtually instantaneously within the limits of a limited plane area in the form of a circle and a process of propagation of a fracture in the ring surrounding it, which arises on the "inclusion contour" with some lag in the conditions for the concentration of stresses and transpires with a finite velocity with an increased density of the energy set free. The authors have established a dependence of the velocity of the focal process in the region of the ring on the extent of the "inclusion" region. The possible variations of the duration of the process and the finite focal radius were found for a given earthquake magnitude.

[421]

ABSORPTION OF LONGITUDINAL WAVES IN EARTH'S UPPER MANTLE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 4, 1978 pp 25-36

[Article by A. V. Yegorkin and V. V. Kun, USSR Geology Ministry, Scientific-Production Combine "Soyuzgeofizika" and Special Regional Geophysical Expedition, "Absorption of Longitudinal Waves in Earth's Upper Mantle"]

[Abstract] On the basis of data from the seismology of artificial shots the author has found the absorption coefficients for longitudinal waves in the upper mantle ($H \leq 100-150$ km). A study was made of their dependence on frequency. The article gives an evaluation of the quality of the upper mantle. The determinations were made on the basis of observations on longitudinal profiles situated in different regions of the Soviet Union. The values α_p and Q_p were obtained for two intervals of depths of the upper mantle: 35-60 and 70-100 km from the earth's surface (with a frequency 1 Hz $Q_I = 210$, $Q_{II} = 310$, $\alpha_{pI} = 1.97 \cdot 10^{-3} \text{ km}^{-1}$, $\alpha_{pII} = 1.18 \cdot 10^{-3} \text{ km}^{-1}$). A comparison was made of the α_p and Q_p values for different regions and there is also a comparison with the results of determination of Q_p made by other authors.

[421]

SUBTRACTION OF PREDICTED FIELDS OF MULTIPLE SEISMIC WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 4, 1978
pp 37-47

[Article by Ye. A. Kozlov, All-Union Scientific Research Institute of Geophysics, USSR Geology Ministry, "Subtraction of Predicted Fields of Multiple Seismic Waves. One-Dimensional Case"]

[Abstract] A scheme is presented for an algorithm for the suppression of multiple waves on seismograms for the simplest case of wave propagation in a one-dimensional vertically inhomogeneous medium (plane waves, normal incidence; absorption and losses in reflection are absent). The solution involves the successive freeing of the records first from a group of multiple waves experiencing at least one reflection from the free surface, then from a group of multiple waves, being reflected at least once downward from the first discontinuity, etc. At each of the stages the suppression of multiple waves is achieved by subtraction from the observed record of the field of multiple waves predicted on the basis of the preceding readings of the observed seismogram and seismograms already partially cleared of multiple waves. The article gives model examples illustrating the workability of the model.

[421]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

ARTICLES DISCUSS SOVIET WORK IN SPACE, HUNGARIAN CONTRIBUTIONS

Budapest NEPSZABADSAG in Hungarian 12, 13 Apr 78

[Parts 2 and 3 of article by Gabor Pal Peto: "Man and the Universe"]

[12 Apr 78 p 6]

[Text] The practical utilization possibilities of man-made satellites were recognized very early, if for no other reason, than that the ideas concerning them--for example in the area of communication--had already existed even when man-made satellites were only being dreamed about.

Meteorology, Navigation

The wide spread of communication through space is well known: in our country also the first ground-station was recently inaugurated in Teliandorogd, for connecting into the Interkosmos network of the socialist countries. Actually, in relaying communication through the man-made satellites the transmission of television programs for the purpose of entertainment is the smaller part of the problem, in contrast with telephone and telex hook-ups. These [satellites] do this work across the oceans. To date this branch of communications has already grown to the point that if it were suddenly terminated, it would cause very great confusion and grave difficulties.

The activity of the man-made satellite photographing the clouds from above has rapidly become an effective tool of the essential task of meteorological work, among others the providing of advance warnings including the forecasting of storms and hurricanes. The Pestlorinc [previously Pestszentlorinc] Institute of the Hungarian Meteorological service has also been receiving such cloud photos continuously and routinely now for over a decade.

The man-made satellites have also been used in so-called radio navigation, servicing to precisely determine the location of ships. Thanks to the man-made satellites watching the movement of these and of the icebergs, no major ship catastrophes or collisions have taken place on the open seas for years. The experts call attention to the fact that the last such major accident occurred on the edge of the Northern Arctic Ocean during the initial

stages of space research. But today the airplanes are also enjoying the advantages of navigation by man-made satellites.

The man-made satellites have also made geodesy, mapmaking, much more precise. Through their assistance it has become possible to triangulate in such areas which earlier were inaccessible. Accurate maps have been prepared successfully about the whole Earth, and cartographic connection was established between the continents.

An interesting feature of the work of artificial satellites researching the Earth is that these use such instruments which originally were designed for the exploration of the atmospheres and surfaces of other planets--"only" now these are turned towards the Earth.

Energy Source Research

The exploration of planets has also led to other important recognitions. For example, that the exploration of the planets (and of the Moon) can be done thoroughly only from space stations revolving around them; the units descending to their surfaces provide important but chancey data, perhaps not characteristic of the whole. (Of course, measurements taken on the surface are also important: these, as it were, verify the data of the space stations.) And from this it allows that our Earth can also really only be thoroughly explored from man-made moons--and the instruments for this have already been worked out for planetary research, so they are usable. That entirely new branch of space research that we call energy source research, the importance of which is easy to understand knowing the environmental protection problems and the energy concern, was born out of this.

The technology of energy resource research was developed by the beginning of the seventies. Through it, the development of the essentially important--because these are not renewable--resources, for example the mineral raw materials energy source inventories can be followed. But the resources which are renewed in cycles can also be learned more precisely, such as vegetables, animals which are used by man, atmospheric oxygen, etc. Without objective data the planning and the defense would move in a vacuum.

In this manner, the first preliminary examinations to discover the location of mineral deposits can be performed rapidly, accurately and cheaply. There are many formations on the Earth's surface which can be recognized only from the height of the man-made satellites--of course, through their high-resolution photographs. For example, a ring-shaped formation was found in Bulgaria in this manner, which had been unknown, even though it was in a populated area.

Water systems and changes in them, water pollution and the sources of the pollutions can be discovered. For ocean fishing, the travel paths of large schools of fish can now be relayed faster and more accurately than ever before to the fishing fleets.

Pictures taken by man-made satellites may discover the spreading of disease in vegetation in the beginning stages. The same thing with forest fires. In Brazil it was possible to determine from such photographs of the branches of frost-damaged coffee plants whether they would sprout new branches next year or whether they should be replanted. Crop estimates can be made with great accuracy using photos by man-made satellites.

Besides the man-made satellites used in everyday life; in communication, transportation, meteorology, cartography, etc., recently an even more significant branch of space travel than this started to grow very rapidly: production in space.

Manufacturing in Space

Even though there had been ideas, the starting point was supplied by an error. There were big problems with the opening of the doors of the first returning space ships, because their metallic material welded together by itself in the strong vacuum of outer space. That is: excellent welds can be made in the vacuum space around the Earth, practically free of cost. This was the starting point of those research projects the first known event of which was the welding done on the Soyuz spaceship. The experiments were then continued during the trips to the Moon, in the Soyuz, Salyut and Skylab experiments, then in the joint Soyuz-Apollo experiments, but even technological research rockets were launched.

Production in space receives its particular significance partly from the almost absolute vacuum and partly from weightlessness, that is, two circumstances which on Earth can in part only be approximated (great vacuum) but in part is impossible to create (lasting weightlessness).

Gravity acceleration on the artificial satellites and space stations is smaller by 4-5 orders of magnitude, that is, one-hundredth of that on the Earth's surface. Thus it does not influence the processes taking place in the materials.

This is very important in growing of silicon and other monocrystals, which are chemically extremely pure and have uniform internal distribution, and which are necessary in communication technology for semiconductors, such as in integrated circuits. That is, when the material of these is melted and allowed to solidify, due to the gravity present on Earth materials of different weight are differentiated, become spatially uneven, thus the crystal's composition in the weightless condition, and in this manner semiconductors, metals and alloys can be produced in the space stations which cannot be made on Earth.

And these have already been manufactured! The last time in the Salyut 6, Soyuz 26, Soyuz 27, Soyuz 28 experiments, which represented tremendous results in this area also.

But spaceship personnel also can--and do--conduct the kind of research for which there is no opportunity on Earth: the phase diagrams--alloying characteristics--of certain alloys which cannot be produced on Earth are eliminated in the weightless condition. These, for example the gold-germa-

nium alloy, are excellent supraconductors, so that it is important to learn their every characteristic.

To prove that all these are not fantasies or utopies, it is perhaps sufficient to mention that piece of data well known in the technical literature that today in the capitalist countries the governmental space research authorities cover only part of the cost of experiments in these areas: 40-50 percent of the costs is accepted by the capitalist private industry. Today, manufacturing in space is economical for the industry of the production cost of these quality materials on the Earth's surface exceeds \$15,000-\$25,000 per kilogram, and this has been reached in the case of some materials.

New Horizons of Production Tools

Space production of technical nature can be expected soon, for example in the production of tungsten of very high quality. This also affects and may interest Hungary, since we are a country producing incandescent lamps in large quantities. As shown also by the Salyut 6--Soyuz 28 experiments, the experiments are also conducted within the framework of Interkosmos, the socialist countries' joint space research program.

It is interesting that turbine blades are expected to become one of the first products produced industrially on spaceships. That is, if the internal structure of the blade's metal is right in the longitudinal direction, then the blade is firmer, it wears less, and consequently blades of smaller weight can be used. This makes possible significant savings of metal. The life span of such blades is much longer. Today, manufacturing is in the preparation stage.

But perhaps the manufacture of pharmaceuticals is the most important for humanity among the tasks which can be solved within the framework of production in space. On spaceships, because of the use of weightlessness, biologically effective agents have been successfully separated. Progressing along this path, a hormone of the lining of secondary kidney has been produced on a space station, which promotes the proliferation of red blood cells. This product may have tremendous significance before kidney transplant operations, because through its use regular blood transfusions will not be necessary.

Several other similar research projects are being conducted on the space stations to produce pharmaceuticals and medical materials, and for the time being these are not automated because of the sensitive and complicated nature of the tasks. The spacemen are doing this work. And since only very small amounts of these materials, impossible to produce on Earth at all, are necessary, it can be taken for certain that by the beginning of the eighties there will be regular production in space.

All these examples are vocal proof that space travel is the objective need of mankind because it opens up new vistas before the growth of production

We have also mentioned in the foregoing those aspects of space research which affect Hungary. In the concluding part of our series of articles we will speak about the relationship between our country and space research.

PHOTO CAPTION

1. p 6. The electrical equipment built in Hungary at the Budapest Technical University for the Interkosmos-17 man-made satellite. This supplies the feed voltage to all of the artificial moon's scientific instruments.

[13 Apr 78 p 6]

[Text] What are we receiving from space research and what do we contribute to it? How do we benefit from it, and what is it costing us?

In the beginning, of course, space research was a scientific question in Hungary also, and the approach to it was also scientific. That is, researchers dealt with it: first with observation of man-made satellites through optical means (telescopes), then with radio observations. And they were not very enthusiastically understood all of the time. But this situation soon changed because the first experimental reception of a meteorological picture occurred in 1966 (at the Budapest Technical University). Barely a year later the method of reception was considered to have been worked out--this required adaptation and application research work--, and in 1967-1968 in the Pestlorinc Institute of the National Meteorological Service the regular reception of pictures commenced as a service. Since then it has continued regularly.

The first successful long-distance transmission-reception experiment in Hungary took place in 1968. The peak of this development thus far has been the placing in operation of the recently inaugurated Intersputnik-station in Taliandorogd.

The Sputnik is Free

A very important date must be recorded here in the history of Hungarian participation in space research, which fell between these two and without which this could not be understood.

In 1967 the Soviet Union proposed to the socialist countries the creation of the Interkosmos organization. Space research cooperation is realized within the framework of this. This takes place in such a way that the Soviet Union provides the transporting rockets, the majority of the artificial satellites, the personnel of the launching stations, the operating time, the launching trajectory for all participants--and no payment is required for the launching of the man-made satellites. (But in ESRO, the joint space research organization of the Western European countries the participants have to pay!) In this manner it has become possible for us to participate in this important and exciting work of space research even in spite of the absolute costs which are unimaginable for our country.

What do we receive within the framework of this cooperation? As far as physical research projects are concerned, we are free to use all of the given opportunities on the basis of reciprocity. We have already mentioned the pictures received by our meteorological service. But beyond this, the Ferihegy Airport was one of the first in Europe to which reception from

man-made satellites became available. We are participating in the Inter-sputnik man-made satellite communication network with the Taliandorogd station. This makes possible not only the forwarding of television programs, but at the same time telephone conversations and telex transmissions can be relayed.

Resource research--about which we spoke in more detail in our previous article--is being conducted also within the framework of the Interkosmos-cooperation. From this, Hungary will receive the pictures taken of the country's area--part of these are still in the experimental stage, but others are routine services! --moreover, these pictures will be prepared with our viewpoints [interests] prevailing.

Within the framework of the Interkosmos cooperation we will receive from the Soviet Union--free--the method of selection and training of our future spaceship personnel.

We Transport Ideas

Of course, besides the work of the future Hungarian space pilot, Hungary has already also contributed to space research.

There were jointly manufactured Hungarian-Soviet micrometeorite traps on the Vertikal-1 research rocket launched in 1970 and on the Vertikal-2 launched in 1971. The Interkosmos-6 man-made satellite launched in 1972 also carried similar instruments. These instruments were designed and built by the co-workers of the Central Research Institute of Physics of the Hungarian Academy of Sciences in Hungarian-Czechoslovak-Soviet cooperation.

The first instrument of Hungarian manufacture actively operating in space was that micrometeorite-detector, or its electronic components which were aboard the Interkosmos-12 satellite, sent into orbit in 1974. The Interkosmos-14 of 1975 and Interkosmos-17 of 1977 also carried such instruments manufactured by KFKI. The units connected to it were Soviet and Czechoslovak manufacture. The Vertikal-6 rocket launched in 1977 carried two kinds of Hungarian (KFKI) instruments for the measurement of charged particles.

Some more about instruments and electronics: the feed units and transformers built at the Budapest Technical University are worthy of being mentioned. These were built into the equipment of Interkosmos-15 of 1976, and the above mentioned Interkosmos-17.

We have also supplied ideas for many other space research experiments. Hungarian researchers have created many data processing methods, and made successful contributions to the solution of a number of theoretical questions.

The Hungarian research institutions have also participated in the analysis of rock samples brought back from the Moon by the Luna-16 Soviet space station.

They have also participated in exploring the night ionosphere of the planet Venus.

Hungarian experts have also taken part in work aimed at explaining the irregularities in the movement of radio signals near the Sun.

The Hungarian "Phantom"

Among the medical-biological research topics the Hungarian researchers participated in the following ones: examination of radiation biology and radiation protection questions, study of disturbances occurring in the balance organ in the state of weightlessness, blood research, physiology research, research of the brain and nerve activity. In this area the creation of the so-called phantom has led to outstanding results. This is a human-shaped puppet on which biology of radiation effects can be studied. The significance of this is very great from the viewpoint of protecting the spaceship personnel from radiation. To wit, working out the design of a modern dosimeter--that is, an instrument which serves to measure radiation dosage--is also the recognized achievement of Hungarian researchers.

In the important Biosputnik experiment conducted in 1977--during which many kinds of live organisms were launched on man-made satellites--our researchers accepted significant assignments in examining radiation hazards and in the preparatory work of materials research.

All these things--quantitatively--perhaps seem little, but this would be a completely erroneous evaluation of things. Our country has contributed in many ways to the utilization and enrichment of the results of space research.

And the intellectual contribution with which the Hungarian physicists, astronomers, mathematicians, technical experts, physicians, etc. participated in solving the problems during the joint work, is difficult to illustrate, since we were not trying to demonstrate because in Interkosmos cooperation neither rivalry nor debates about credit are the usual fare: the achievements are joint. And--this must not be lost from sight--due to the complicated nature and global, that is, Earth-scale extent and size, or even beyond that, of space research, international cooperation is very broad-based even if not always as spectacular as was the flight of the Soyuz-Apollo joint Soviet-American manned mission.

Space research is creating the foundations for the beginnings of a new type of civilization and no one can be left out of it, whether they like it or not. Recognizing the horizons, Hungary has joined this era-shaping undertaking consciously and with moderation, in proportion to our resources and opportunities, but also in a manner not sparing these.

The scientific advisor for our series of articles was Csaba Ferencz, department head of the government committee for space research.

PHOTO CAPTIONS

1. p 6. The experimental antenna system of the Budapest Technical University for observing man-made satellites. Among other things, the cloud pictures of the Meteor Soviet meteorological satellite are also received by this.
2. p 6. The first active Hungarian space research instrument: the electronics of the micrometeorite-detector. It was prepared by the experts of KFKI [Central Research Institute of Physics] and it traveled in space on the deck of Interkosmos-12.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1010"

Moscow PRAVDA in Russian 24 May 78 p 6

[TASS Report: "'Kosmos-1010'"]

[Abstract] The artificial earth satellite "Kosmos-1010" was launched in the Soviet Union on 23 May 1978. The satellite was inserted into an orbit with the following parameters:

- initial period, 89 minutes;
- apogee, 257 kilometers;
- perigee, 218 kilometers;
- orbital inclination, 81.4 degrees.

Incoming information is being transmitted to the state scientific research center "Priroda" for processing. [5]

[422]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1012"

Moscow PRAVDA in Russian 27 May 78 p 3

[TASS Report: "'Kosmos-1012'"]

[Abstract] The artificial earth satellite "Kosmos-1012" was launched in the Soviet Union on 25 May 1978. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.2 minutes;
- apogee, 280 kilometers;
- perigee, 214 kilometers;
- orbital inclination, 62.8 degrees.

The satellite carries a radio transmitter operating on a frequency of 19.995 MHz.

[423]

Note: A report on the launching of the AES "Kosmos-1011" was included in the preceding issue of GEOPHYSICS, ASTRONOMY AND SPACE.

TASS ANNOUNCES LAUNCHING OF "MOLNIYA-1" COMMO SATELLITE

Moscow PRAVDA in Russian 4 Jun 78 p 3

[TASS Report: "'Molniya-1'"]

[Text] On 2 June 1978 a "Molniya-1" communications satellite was launched in the Soviet Union. The "Molniya-1" communications satellite is intended for operation in the system of long-range telephone and telegraph radio communication and also for the transmission of USSR Central Television programs to points in the "Orbita" network situated in regions of the Far North, Siberia, the Far East and Central Asia.

The satellite was inserted into a high elliptical orbit with the following parameters:

- apogee, 40,837 kilometers;
- perigee, 457 kilometers;
- period of revolution, 12 hours 16 minutes;
- orbital inclination, 62.5 degrees.

In addition to the apparatus for transmission of television programs and for providing long-range multichannel radio communication, the satellite has on board a command and measurement complex and also systems for orientation, orbital correction and power supply for the satellite.

According to the data received, the apparatus installed on the satellite is functioning normally. Communication sessions using the "Molniya-1" satellite will be conducted in accordance with the planned program.

[424]

TASS REPORTS ON END OF COSPAR SESSION

Moscow TASS in English 1934 GMT 10 Jun 78

[TASS Report: "To Expand International Cooperation"]

[Text] Innsbruck, 10 June. TASS. TASS Correspondent Mikhail Kochetkov reports:

The 21st session of the Committee on Space Research (COSPAR) ended today in the House of Congresses. Taking part in the session were scientists and specialists from 34 countries, including the USSR.

Soviet cosmonauts Yuriy Romanenko and Georgiy Grechko took part in the work of the session. They told the participants in this major international forum about the results of the research carried out during the longest space flight that was made — on board the orbital complex "Salyut-6"—"Soyuz."

Speaking at a press conference about the results of the session, the President of the Committee on Space Research Professor de Jager of the Netherlands emphasized the importance of such forums for widening international cooperation in the exploration of outer space.

The head of the Soviet delegation, Academician Boris Petrov, spoke in detail about future space flights with the participation of international crews. He said that international crews including citizens of Poland and the German Democratic Republic will make space flights this year. Representatives of all countries that participate in the "Interkosmos" program will take part in space flights in the future.

The scientific program of COSPAR for 1979 has been adopted at the closing meeting of the session. A number of organizational matters were discussed and a new president of COSPAR was elected. French scientist Professor Jean Francois Denisse became COSPAR president.

In an interview with a TASS correspondent he said that one of the aims of the organization in the years ahead is the widening of cooperation among different countries in space exploration. He stressed that the joint research that has been conducted by Soviet and French scientists for a number of years now sets a good example of such cooperation.
[429]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1022"

Moscow PRAVDA in Russian 13 Jun 78 p 3

[TASS Report: "'Kosmos-1022'"]

[Abstract] The artificial earth satellite "Kosmos-1022" was launched in the Soviet Union on 12 June 1978. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.7 minutes;
- apogee, 374 kilometers;
- perigee, 182 kilometers;
- orbital inclination, 72.9 degrees.

[439]

[Note: See next item for earlier report on simultaneous launching of eight "Kosmos" series satellites.]

TASS ANNOUNCES LAUNCHING OF EIGHT "KOSMOS" SATELLITES

Moscow PRAVDA in Russian 9 June 1978 p 3

[TASS Report: "Eight Satellites in Flight"]

[Abstract] On 8 June 1978 the following eight artificial satellites were launched by a single booster rocket in the Soviet Union: "Kosmos-1013," "Kosmos-1014," "Kosmos-1015," "Kosmos-1016," "Kosmos-1017," "Kosmos-1018," "Kosmos-1019," "Kosmos-1020." The satellites were inserted into an orbit with the following parameters:

- initial period, 115.6 minutes;
 - apogee, 1,539 kilometers;
 - perigee, 1,456 kilometers;
 - orbital inclination, 74 degrees. [5]
- [446]

GEORGIY GRECHKO ADVISES "SOYUZ-29" COSMONAUTS

Moscow PRAVDA in Russian 20 Jun 78 p 3

[Article by V. Gubarev]

[Text] Finally the crew has established a day-to-day regime. The day has become day and the night has become night. Like on the earth. The "topsy-turvy day," when it was necessary to lay down to sleep at sunrise and one had to begin to work as evening began, was a necessary product of ballistics, which required that the ship launching on such an occasion had to occur closer to midnight. But now the road separating Baykonur from "Sal-yut-6" is behind and those two days which V. Kovalenok and A. Ivanchenkov were in the station were spent in such a way as to rest a little from the excitement accompanying docking and to be adapted to the space home itself.

"It's the first working day!" said the operator at the cosmonaut control center on Sunday. "Time to begin demothballing the station..."

"It's a little breezy, cool here," said Vladimir Kovalenok.

"Is the temperature falling?" said the operator with concern.

"No. It's simply that the nearby fan is operating. Earlier it was a little hot. I have in mind the launching, maneuvering and docking."

"We have rain here," said the operator in complaint.

"You can envy us, the climate here is stable."

These were the first radio dialogues between the earth and "Salyut-6." Indeed, the operators at the Control Center and the crew have already worked together for many months. They perfected all the stages in the flight and became acquainted with one another. Already while at Baykonur Aleksandr Ivanchenkov noted: "For the time being everything is like on a trainer." Later this phrase sounded twice during the docking and then we heard it again from the "Salyut-6." The cosmonaut wanted to say that for the time being there was nothing unexpected, nothing unusual. But this is not entirely so. Or to be more exact, it is not true at all. The acute period of adaptation to weightlessness was still not completed, although its peak is behind. The sensations of pain have not disappeared and there is a sensation of a strong flow of blood to the head. The physicians recommend that the cosmonauts not make sharp movements and to take care with their movements through the station -- it is still difficult to evaluate the force of thrusts while floating in a state of weightlessness. The very process of making the new space home comfortable is in progress; this is the home in which Kovalenok and Ivanchenkov must work.

"Transmit thanks to the 'Taymyry'," reminds Kovalenok, "their advice is very useful and the schedule is reproachless..."

This was in mid-February. At the Flight Control Center I met Vladimir Kovalenok. In the interval between regular training sessions he entered into communication with the "Taymyry."

"After landing come to see us," said Georgiy Grechko then, "I emphasize, on the very first day, before the sensations have worn off. We will tell you much..."

"Without fail," responded Kovalenok. "Could you not write out a schedule? If you do this, to be sure, do not make it hard on yourself...Write down what comes to you. And then a little bit more."

"We'll do it. And the rest you will see for yourself," and it seems that Yuriy Romanenko smiled.

No, he said nothing to his friends after return about those souvenirs which the "Taymyry" prepared for the "Fotony." He was also silent at the cosmodrome while leading the "Soyuz-29" crew into space. And now at the hatch separating the ship from the station Vladimir Kovalenok and Aleksandr Ivanchenkov read: "Good journey; it is easier if you meet a good fellow traveller." Then they discovered a note with good wishes. Finally, they saw a large photograph: a girl in a birch grove. Near Moscow. A tiny corner of the Motherland. So far for them in these moments and infinitely close always.

"They frequently will look at this photograph for a long time and recall the forest, stream and the scents of earth," says Georgiy Grechko. "To be sure, they will sometimes grow sorrowful and they will long for their near and dear and will dream about a return. It cannot be otherwise; after all

we are human beings, not robots. But the most important thing in their life now is work. We endeavored to tell them not only about what we learned during 96 days of flight, but also about what we did not learn. Indeed, the more you fly, the more is unknown to you. The first day on the 'Salyut' was singular and exceedingly important for all subsequent work. They began to 'enliven' the station. This did not just involve activation of different instruments and apparatus. Each one selects his favorite corner where he fastens his sleeping bag and learns how it is more convenient to sleep and move. Kovalenok and Ivanchenkov are developing their 'life style' in space; it should be stable and we so advised them. Various flight factors, cases and events will disturb their schedule, but it is exceedingly important that it be adhered to carefully. In space it is impossible to be inconsistent -- today one way and tomorrow a different way. And then, as Vitaliy Sevast'yanov says, 'everything rolls along, day after day, experiment after experiment.' Volodya Kovalenok and Sasha Ivanchenkov are friends and they are beautifully trained. And there is no doubt but that the 'space life style' will be stable for them."

The prediction of Georgiy Grechko is precise. Already the first working day aboard the "Salyut-6" it was confirmed that the Central Control operators and the cosmonauts are acting smoothly, splendidly understanding one another.

I am taking the records of the radio conversations of the first crew and the present one. I compare them. And there is a difference. Georgiy Grechko immediately after transfer into the station took the initiative into his hands. He frequently gave recommendations to the operators and even corrected them. This is natural: after all, Grechko flew for a month in the "Salyut-4" and he had a great amount of work experience in space. For Kovalenok and Ivanchenkov there was much that was still new and therefore the earth more carefully monitors each of their steps. And so it should be.

"The beginning of work is similar for all crews," says K. P. Feoktistov. "A rigid schedule, a clear and very saturated program. And the crew's work style is manifested a little later."

"To what do you attribute the fact that there was such a prolonged interval -- three months -- between the first and second expeditions?"

"It was necessary to make a careful analysis of the results of the flight of Yuriy Romanenko and Georgiy Grechko," responds the designer. "The crew passed 96 days in space and the physicians carefully investigated whether the cosmonauts exhibited any dangerous changes. It is now clear that there were none. We once again have convinced ourselves that such a prolonged flight is no threat to human health. Second, it was necessary to convince ourselves of the good functioning of the equipment. Nevertheless, of three manned ships one automatically worked with the station. A very stressed program. A number of comments and wishes were expressed by Romanenko and Grechko. These had to be taken into account. In particular, the new crew now had an ordinary work week and two days off. And sleep was prolonged -- nine hours were now allocated to it. The 'Soyuz-29' crew delivered a number of instruments to the

station. They were to replace those whose useful life was running out. The 'Salyut-6' has been in orbit since September of last year and up to now we have been working with the original sets of equipment. This is evidence of the reliability of the space complex."

[449]

TASS ANNOUNCES PLANS FOR LAUNCH OF INDIA'S SECOND SATELLITE

Moscow TASS in English 1410 GMT 13 Jun 78

[Text] Moscow, 13 June, TASS -- The Soviet side has fulfilled its obligations to the Indian colleagues and is ready to launch the second Indian satellite, as soon as its flight model is ready, a TASS correspondent has been told by the deputy chairman of the "Interkosmos" council Nikolay Novikov, who led the USSR's delegation to a meeting of Soviet and Indian specialists in Bangalore, India.

The meeting made it possible to specify a number of matters related to the launching of the second Indian satellite by a Soviet carrier rocket. Autonomous and complex trials of the satellite were carried out, and all technical and engineering matters have been determined. Nikolay Novikov emphasized that the businesslike and friendly meeting between specialists of the two countries was held in an atmosphere of full mutual understanding.

Cooperation between scientists is underway in accordance with the agreement between the USSR Academy of Sciences and the Indian Organization for Space Exploration, signed in Moscow in April 1975. India's second satellite, just like the first one, will be launched from the territory of the Soviet Union. Its weight will be 420 kg. It is designed for experimental observations of the earth's surface from outer space.

Just as at the launching of the first Indian satellite "Ariabata" the USSR will provide the carrier rocket and the launch complex and will put it into the agreed-upon orbit at an altitude of about 500 kilometers. Indian specialists will be given the opportunity to use the ground station "Bear Lakes" to obtain information and monitor the satellite at the first stage of the flight. All this is done on a gratuitous basis, said Nikolay Novikov.

[436]

MEDICAL AND METALLURGICAL EXPERIMENTS IN SPACE DESCRIBED

Moscow PRAVDA in Russian 22 Jun 78 p 6

[Article by A. Pokrovskiy: "Attention, Experiments"]

[Abstract] Candidate of Medical Sciences A. A. Lepskiy reports that the biological experiments have now begun aboard the spacecraft. In particular, the cosmonauts moved from the transport ship to the station two containers with fungi and two with a nutrient medium. They also placed in biotherms a number of inserts with the eggs of frogs and flour beetles. The objective is to obtain new information to supplement data on the influence of weightlessness on living organisms and on their hereditary characteristics. In the field of gravitational biology, which has been vigorously developing recently, such materials are being used both for solution of a number of practical problems, such as increasing the yield of plants and the productivity of cattle, as well as for a deeper theoretical understanding of the fundamentals of life. Kovalenok and Ivanchenkov began their scientific work without ending the demothballing of the station. But it is better to say that these two tasks were performed simultaneously. Thus, while making themselves at home on the "Salyut-6," they activated a mass meter which even under weightlessness conditions makes it possible to determine the weight of a body. And they immediately made the necessary measurements. Doctor of Medical Sciences A. D. Yegorov stated that it is well known that weightlessness causes an inflow of blood into the upper part of the torso. The body reacts to this by an intensified elimination of water and the cosmonauts begin to lose weight. Obtaining a clarification of the dynamics of this process means a better understanding of the course of adaptation to weightlessness, and on the other hand, adaptation to terrestrial conditions after flight. And still another detail. The "Fotony" brought with them a new fan for installing on the "Splav-01", since it was decided to replace the old one with one which was less noisy. Corresponding Member USSR Academy of Sciences L. N. Kurbatov stated that encouraging results have already been obtained with the "Splav-01." Yu. Romanenko and G. Grechko carried out the melting of a solid solution of cadmium and mercury tellurides. This material was selected because its components differ sharply with respect to density and under terrestrial conditions it is extremely difficult to obtain a homogeneous alloy. But it is needed by the fabricators of sensing elements of detectors of IR radiation which are being used increasingly more frequently for obtaining the thermal image of the human body in medicine, in the search for thermal waters in geology, in the radio industry for monitoring the operation of different parts and components, etc. Therefore, although industry requires it in small quantities, the cost of the alloy is very high. But these same two circumstances determined the choice of space as a promising place for the production of this semiconductor because weightlessness helps to obtain a homogeneous alloy and the small quantities favor transport from orbit to the earth. Calculations have been confirmed. An analysis of the samples obtained by Romanenko and Grechko indicates a high homogeneity of the semiconductor. Now that the apparatus has demonstrated its reliability, there can be hope for obtaining materials suitable for industrial use.

[454]

Abstracts of Scientific Articles

EFFECTS EXERTED ON THE OZONOSPHERE BY DIFFERENT SUBSTANCES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 4, 1978 pp 355-365

[Article by V. L. Tal'roze, A. I. Poroykova, I. K. Larin, P. S. Vinogradov and E. Ye. Kasimovskaya, Institute of Chemical Physics, "Chemical-Kinetic Criteria for the Effect Exerted on the Ozonosphere by Substances of Natural and Anthropogenic Origin"]

[Abstract] The authors present an analysis of the principal cycles of the destruction of ozone, including nitrogen, hydrogen, haloid and oxygen cycles. It is shown that the role of each of these cycles is determined by one or two fundamental processes with the participation of oxygen atoms or ozone molecules. Expressions are derived which make it possible to evaluate the contribution of each cycle to the total rate of ozone destruction. This comparative analysis of the rate of destruction of ozone in reactions with different catalysts revealed that there are two fundamental types of processes (cycles A and B) for the destruction of stratospheric ozone and made it possible to derive a simple analytical expression for evaluating the contribution of different cycles to the total rate of ozone destruction. The article gives computations of the individual effectiveness of known catalysts with respect to ozone, expressed by the number of molecules of "odd" oxygen (O and O_3) annihilated by one particle of the catalyst (length of chain ν). Expressions are derived for the criteria for preservation of the ozonosphere, relating the stipulated rate of ozone destruction and the concentrations of different catalysts and the intensity of their sources in the stratosphere.

[411]

VI. MISCELLANEOUS

News

"KOSMOS-1000" AIDS ORIENTATION OF ICEBREAKER "SIBIR'"

Moscow PRAVDA in Russian 31 May 78 p 6

[Article by V. Chertkov: "In the Upper Latitudes"]

[Excerpt] The most interesting part of the program to be carried out during the cruise [of the "Sibir'"] is related to the space program.

A satellite specially intended to aid navigation, "Kosmos-1000," was launched on 31 March.

The "Sibir'" will be the first icebreaker to make use of this satellite for orientation. Thus, during this cruise traditional methods will be supplemented by space methods of navigation. The ship will also receive information from a "Meteor" series satellite that records cloud cover and snow and ice formation. Incidentally, high-quality photographs taken from the satellite have already been received. They will help the convoy to select the easiest route. Information from the satellite will make it possible to plot with precision the location of massive ice forms in the Arctic seas, that is, to conduct ice reconnaissance necessary for planning and implementing transport operations.

The application of a number of space systems and instruments to safeguarding the Arctic cruise of an atomic icebreaker is being tested on the "Sibir'." It will probably soon be possible to transmit to the press the first reports from the Arctic via a "Molniya" satellite.

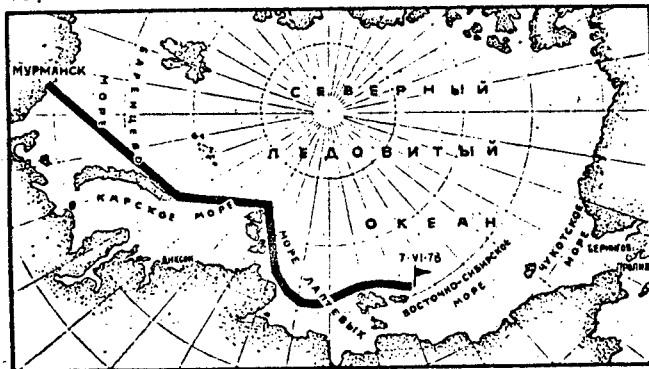
At the present time the atomic cruiser's receiver is tuned into an "Ekran" satellite for relaying transmissions... [5]
[426]

HEAVY ICE IMPEDES MOVEMENT ALONG NORTHERN SEA ROUTE

Moscow IZVESTIYA in Russian 8 Jun 78 p 3

[Article by V. Shmyganovskiy]

[Summary] Eighty miles to the east of Novaya Sibir' Island the atomic ice breaker and the "Kapitan Myshevskiy," which it is escorting, have encountered very difficult perennial ice of the so-called Ayonskiy mass. The "Sibir'," by the impacts of its hull, has attempted to smash through, but in a period of four hours it was only possible to proceed 400 meters...



Route taken by convoy after departure from Murmansk.

It was decided to stop. The polynia through which the vessels had been rapidly moving forward had been replaced by hummocked ice 7 to 10 meters thick. The floe was beautiful, banded in dark blue, light blue, ultramarine and even pale green...The chief of the "Aysberg" Central Design Bureau, V. Starshinov, reported to the bridge that the atomic icebreaker was listing 20°. The vessel supposedly is capable of withstanding a list of 30-40°, but that is when it is rolling in the open sea. But a list of 20° in ice is rare indeed. The water from the inside swimming pool flooded the recreation room, everything fell and slipped off tables and shelves...The standstill lasted 20 hours. Then, after analyzing new data from an ice reconnaissance and after maintenance work on some mechanisms, on 6 June at 1600 hours the atomic icebreaker again penetrated into the ice. As before, the conditions were difficult...In 12 hours -- by 1200 hours on 7 June -- a distance of 100 miles had been covered.

[438]

WORK OF SOVIET GLACIOLOGISTS REVIEWED

Tashkent PRAVDA VOSTOKA in Russian 24 May 78 p 4

[Article by V. Suslov: "From the Pamirs to the BAM"]

[Summary] A working conference of the Glaciology Section of the Interdepartmental Geophysical Committee has been held at Zvenigorod. Those in attendance summarized the results of activity of Soviet glaciologists during the past year and outlined the prospects for further research. Much attention was devoted to the problems of glaciology in Central Asia which are being solved by the scientists of the Central Asian Regional Scientific Research Hydrometeorological Institute. Specialists at the institute are engaged in creation of methods for remote determination of the depth and liquid water content of the snow cover by means of an aerial gamma survey. This is making it possible to obtain reliable data on the liquid water content of the snow from a helicopter, the development of aerial remote reconnaissance surveys in place of ground surveys for determining the depth of the snow from rods which had been placed earlier. But there can be gaps in data due to periods when flight is impossible. In order to avoid this, institute glaciologists together with specialists at the Kiev Institute of Automation are working on the creation of a universal telemetric device which is capable, regardless of the weather, of radio transmission of information important for routine forecasts of the parameters of the snow cover -- its depth, density, rate of settling, and time of descent of avalanches. Another important problem which is being solved by institute glaciologists is a study of the regime and hydrology of glaciers. Many years of work have been completed on creation of a method for using an electronic computer to calculate the volumes of total thawing of the glaciers in Central Asia. This will make it possible to refine the forecast of the runoff of mountain rivers. A merit of the method is use of standard meteorological information in the computations, this making it unnecessary to carry out time-consuming observations on glaciers. The Glaciology Section approved the studies made of the regime and water-ice balance of the basin of Abramov Glacier during the period of the IHD and recommended that this work be continued. Much attention was devoted to study of dangerous glacial processes, including sudden pulsation of glaciers. On the basis of the latest data in the USSR Catalogue of Glaciers and aerospace materials it was possible to compile a detailed map of pulsating and potentially dangerous glaciers of the Pamir-Alay. It will serve as a valuable basis for forecasts. The Glaciology Section adopted a resolution calling for the compilation of a complete catalogue of pulsating glaciers in the USSR by 1980. Glaciologists throughout the country are working on the creation of an Atlas of Snow and Ice Resources of the World. More than 30 special maps in the atlas for Central Asia are being compiled by Tashkent glaciologists. After many years of interruption, work has been renewed on investigation of Fedchenko Glacier. Equally important is a study of avalanches within the boundaries of the republic and in Transbaykalia on the route of the Baykal-Amur line, where the Baykal-Amur Avalanche Expedition of the institute has been working year-round since 1975. On the basis of these investigations it was possible to compile a detailed map of avalanche danger for all mountain sectors along the line under construction. Detailed research has also been carried out in the Pamirs. More perfect methods for predicting avalanches are being developed.

[425]

KAPITAN MYSHEVSKIY LED INTO OPEN WATERS

Moscow PRAVDA in Russian 14 Jun 78 p 6

[Article by V. Chertkov: "Through Five Seas"]

[Abstract] The icebreaker "Sibir" has conducted the diesel-electric transport ship "Kapitan Myshevskiy" into open waters on its course to Magadan. The "Sibir" is continuing to sail north toward the "Severnnyy Polyus-24" polar drifting station. [5]

[448]

ARCTIC CONVOY ALTERS COURSE

Moscow IZVESTIYA in Russian 17 Jun 78 p 3

[Article by V. Smyganovskiy]

[Abstract] For the first time on its voyage from Murmansk the diesel-electric transport ship "Kapitan Myshevskiy" has touched shore; it has entered Provideniya Bay. One of the reasons for this course deviation is the necessity for carrying out an examination of the vessel by divers. After all, the severe impacts of enormous floes do have an effect even on a thick metal hull. And there have been hundreds of them. And the tests of the Arctic began for the vessel not at the end of May, when the expedition departed from Murmansk, but much earlier, in mid-October. The "Kapitan Myshevskiy" belongs to the Far Eastern fleet. In October, when anchored at Pevek, the order came to proceed into the western regions of the Arctic. The seamen worked for seven months in the ice between Murmansk and Dudinka. The captain Timofey Krivokhizhin stated that it was a difficult task following the infinite number of changes in the course of the icebreaker and constantly controlling the speed of the vessel. Care had to be taken to avoid the floes which headed straight for the ship behind the screws of the icebreaker "Sibir". The vessel remained a little more than a day in Provideniya Bay. Divers carefully inspected the hull. The floes left conspicuous scars on the hull, but they were not dangerous. The supply of fresh water was replenished here. The ship is proceeding to its destination at Magadan, a port where it is being awaited with impatience after completing the first through voyage along the great Northern Sea Route at such an early season of the year (May-June) and in an unusually short time. According to calculations, the freighter with its load of construction materials will reach Magadan on 21-22 June, only four weeks after its departure from Murmansk.

[447]

ICEBREAKER "SIBIR'" REACHES POLAR DRIFTING STATION

Moscow IZVESTIYA in Russian 22 Jun 78 p 3

[Abstract] The atomic icebreaker "Sibir'" has reached the polar drifting station "Severnny Polyus-24," delivering supplies and a team of scientists.

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[452]

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