

Russian and Japanese Aerospace Literature

Throughout 1993 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Planetary/Space Exploration from Russia and Superconductors from Japan.

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Russian Aerospace Literature This month: *Planetary/Space Exploration*

A93-18412 Physical fitness as a criterion of readiness for space-flights (Zhizneustoychivost' cheloveka kak kriterii gotovnosti k kosmicheskim poletam). A. I. IAROTSKII, 25th K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, Kaluga, Russia, Sept. 11-14, 1990, Transactions (A93-18406 05-52). Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, pp. 37-42. 9 Refs.

The 35 components of an 'algorithm' defining the physical and physiological factors determining the ability of man to adapt to the conditions of space travel are presented, with particular attention given to the ability of man to endure hypogravity and hypokinesia as well as conditions inducing motion sickness. These special physical-fitness prerequisites were determined using results of 30 years of physiological studies of reactions in space crews, as well as results from more than a 1000 literature reports.

A93-18411 Problems of medical support during extravehicular activity during flights to Mars (Meditsinskie problemy obespecheniia vnekorabel'noi deiatel'nosti pri poletakh na Mars). A. S. BARER, N. K. GNOEVAIA, G. A. RYKOV, E. A. SOKOL, and S. N. FILIPENKOV, 25th K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, Kaluga, Russia, Sept. 11-14, 1990, Transactions (A93-18406 05-52). Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, pp. 29-36. 20 Refs.

The technical and medical support needed during extravehicular activity (EVA) of cosmonauts on their flights to Mars is discussed, with particular attention given to the physiological factors involved in EVA activity. It is emphasized that long-term (1.5-2 years) manned flights to Mars require methods based on preliminary studies of medical and biological effects of such flights, conducted under conditions close to those of the Mars, such as during EVA in space or staying for various periods of time in space vehicles orbiting Mars, as well as on studies conducted on earth under conditions simulating Martian gravity and atmosphere. Particular attention is given to the concept of a special spacesuit provided with an autonomous life-support system, which could be used to walking and working on Mars.

A93-18323 New ways of increasing the efficiency of interstellar thermonuclear engines (Novye puti povysheniia effektivnosti mezhzvezdnykh termoiadernykh dvizhitelei.) U. N. ZAKIROV, Rocket and space technology—The ideas of K.E. Tsiolkovsky and modern development; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions (A93-18306 05-12). Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, pp. 117-120. 3 Refs.

Theoretical studies of interstellar thermonuclear engines and successful experiments with hydrogen isotope compression to a density of 100 g/cm have demonstrated possibilities for increasing the efficiency of such propulsion devices. In particular, the efficiency of a thermonuclear engine can be increased by increasing fuel efficiency through the on-board generation of high-efficiency components of the targets detonated in the combustion chamber. A further increase in engine efficiency can be achieved by using an electromagnetic accelerating nozzle extension for increasing the energy of the charged microexplosion products.

A93-18410 Approaches to solving the problem of decompression safety of cosmonauts on their flights to Mars (Podkhody k resheniiu problemy dekompressionnoi bezopasnosti kosmonavtov pri polete na Mars). L. R. ISEEV, E. I. KUZNETS, V. P. KATUNTS, and I. I. MALKIMAN, 25th K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, Kaluga, Russia, Sept. 11-14, 1990, Transactions (A93-18406 05-52). Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, pp. 24-28. 4 Refs.

The prospect of long-term (from 640 to 1160 day long) spaceflights, in particular flights to Mars, calls for the necessity of a special medical support program. Attention is given to methods for conserving in man the original gravity-regulated physiological mechanisms, in order to prepare him for the Martian gravity and for the return to earth, by means of creating artificial gravity in spacecraft. Other problems that must be attended to include the design of special regimens of physical activity under conditions of hypokinesia and hypogravity during spaceflight and of protection against decompression during planetary explorations. A detailed program is proposed which is designed to protect cosmonauts from decompression during spaceflights and during Mars orbit and landing.

A93-18406 K.E. Tsiolkovsky and biomedical problems connected with space exploration; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions (K.E. Tsiolkovskii i biomeditsinskie problemy osvoiniia kosmicheskogo prostanstva; Chteniia, Posviashchennye Ideiam K.E. Tsiolkovskogo, 25th, Kaluga, Russia, Sept. 11-14, 1990, Trudy). V. B. MALKIN, F. P. KOSMOLINSKII, and E. I. KUZNETS, E. I., EDS. Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, 90 pp.

The volume contains papers on Tsiolkovsky's ideas on the problem of human survival in extreme environmental conditions on earth and in space, the interaction of terrestrial and space environments with human life, and the role of human factors in securing safety during spaceflights. Attention is also given to the problem of decompression safety of cosmonauts on a mission to Mars, problems of medical support of EVA during a manned mission to Mars, the factor of physical fitness as a criterion of readiness for spaceflights, and the results from a general model of external information perception. Particular consideration is given to the efficiency of a rehabilitation and prophylactic treatment of civil aviation flight crews, preclinical cardiovascular and neurological occupation-related pathological symptoms in helicopter pilots, psychophysiological studies of acute hypoxia, and the effects of possible atmospheric pollution sources on the growth of selected microorganisms. (For individual items see A93-18407 to A93-18419)

A92-49211 Galileo flyby of the asteroid Gaspra (Prolet KA 'Galileo' vblizi asteroida Gaspra). A. T. BAZILEVSKII, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 26, No. 3, May-June 1992, pp. 3-7. 5 Refs.

The Galileo spacecraft flew by the asteroid 951 Gaspra on 29 Oct. 1991, took TV pictures of the asteroid, and made other observations. This paper describes one of the images that was delivered to the earth; the imaged part of the asteroid is 12 x 16 km across. The shape of the asteroid is rounded-angular, which is typical for bodies of fragmentation smoothed by impacts of small meteoroids.

A93-18325 The philosophical heritage of K.E. Tsiolkovsky and the formation of an integral mankind; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 24th, Kaluga, Russia, Sept. 12-15, 1989, Transactions (Russian book) *Filosofskoe nasledie K.E. Tsiolkovskogo i stanovlenie tselostnogo chelovechestva; Chteniia, Posviashchennye Ideiam K.E. Tsiolkovskogo, 24th, Kaluga, Russia, Sept. 12-15, 1989, Trudy*. V. V. KAZIUTINSKII, G. S. KHOZIN, A. D. URSUL, and O. N. GZOVSKAIA, EDS. Moscow, AN SSSR, Institut Istorii Estestvoznaniia i Tekhniki, 1991, 187 pp.

The role and place of Tsiolkovsky's so-called cosmic philosophy in the creation of a new interdisciplinary paradigm corresponding to the realities of an integral civilization are examined. Philosophical and methodological questions connected with the problem of the noosphere in the context of the worsening global ecological problem are discussed. Particular attention is given to the anthropic principle, especially in connection with the problem of possible cosmic civilizations; the role of astronautics as an important condition of social progress; and the conception of a terrestrial civilization open to constructive interaction with the universe. (No individual items are abstracted in this volume)

A93-18306 Rocket and space technology—The ideas of K.E. Tsiolkovsky and modern development; Lectures Devoted to K.E. Tsiolkovsky's Ideas, 25th, Kaluga, Russia, Sept. 11-14, 1990, Transactions (Russian book) *Raketa i kosmicheskaiia tekhnika—Idei K.E. Tsiolkovskogo i sovremennoe razvitiie; Chteniia, Posviashchennye Ideiam K.E. Tsiolkovskogo, 25th, Kaluga, Russia, Sept. 11-14, 1990, Trudy*. E. K. MOSHKIN, V. V. BALASHOV, V. P. KAZNEVSKII, and I. A. MERKULOV, EDS. Institut Istorii Estestvoznaniia i Tekhniki, 1991, 128 pp.

The papers presented in this volume focus on recent theoretical and experimental research related to rocket and space technology. Topics discussed include the problem of earthquake prediction by space methods, mathematical support of geophysical experiments conducted at the Mir orbital complex, local stationary orbits of artificial earth satellites, and terminal guidance of a gliding flight vehicle on the basis of the angle of roll at the final stage of descent. Attention is also given to a new method for determining the number of flight vehicle prototypes subject to full-scale testing, optimal damping of the vibrations of the elastically attached fragments of large-scale space structures, and generation of artificial gravity in two-mass systems without balancing. (For individual items see A93-18307 to A93-18324)

A93-18175 Possible version of the earth energy supply from space in the 21st century and first-stage proposals (O vozmozhnykh variantakh energosnabzheniia zemli iz kosmosa v XXI v. i predlozheniakh po pervomy etap). V. N. AKIMOV, IU. M. ES'KOV, A. S. KOROTEEV, and V. F. SEMENOV, *Rossiiskaia Akademiia Nauk, Izvestiia, Energetika* (ISSN 0002-3310), No. 4, July-Aug. 1992, pp. 92-103. 7 Refs.

The dynamics of the global structure of primary energy sources and current and future trends in the development of power supply on earth are briefly reviewed. In particular, attention is given to the possibility of using some space-based energy sources with the remote transmission of power to the earth. It is suggested that space-based energy sources could supply up to a total of 10 terawatts of power. Proposals for the first stage of the development of a space-based power supply system are discussed. These include the establishment of a polar lighting system using film reflectors of solar radiation, power transmission systems with a capacity of 10 Gw, and power supply of remote areas on earth from space-based power plants up to 1 Mw.

A93-15260 Remote determination of the characteristics of anthropogenic contaminants in space using optical methods (Distantionnoe opredeleniie kharakteristik iskusstvennykh kosmozol'nykh obrazovani opticheskimi metodami). T. V. BUZDYGAR, V. V. GAPLEVSKAIA, I. V. DOROKHOVA, O. F. KLIUEV, and P. G. MATUKHIN, *Sibirskii Fiziko-Tekhnicheskii Zhurnal* (ISSN 0869-1339), No. 3, May-June 1992, pp. 91-100. 9 Refs.

An experimental method for determining the parameters of anthropogenic contaminants in space is described. The method includes visualization of the components of simulated anthropogenic contaminants under natural conditions using optical remote sensing equipment and determination of the contamination parameters from the optical images using digital image processing tools. The structural and dynamic parameters of several types of contaminants determined by the method described here are presented.

A92-26019 A method for a comprehensive assessment of technical equipment for the medical compartment of a spacecraft (Metodika kompleksnoi otsenki tekhnicheskogo osnashcheniia kosmicheskogo meditsinskogo bloka). A. V. PERKOVSKII and B. A. ADAMOVICH, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 49-53. 32 Refs.

The paper describes the development of a model of a bacterial defense system (BDS) to be included in the medical compartment or medical section of a spacecraft. The BDS is designed to maintain, in the area designated for medical treatments, conditions of constant temperature, relative humidity, gas exchange, and desired ratios of atmospheric gases, as well as to keep low the levels of bacterial and particle contamination. Special attention is given to the method used for the assessment of the BDS, the set of factors to be assessed, and a model of a data base for computing the cost efficiency of the BDS.

A93-15222 Convective processes in microgravity (Konvektivnye protsessy v nevesomosti). V. I. POLEZHAIEV, M. S. BELLO, N. A. VEREZUB, K. G. DUBOVIIK, A. P. LEBEDEV, S. A. NIKITIN, D. S. PAVLOVSKII, and A. I. FEDIUSHKIN, *Izdatel'stvo Nauka*, 1991, 240 pp. (ISBN 5-02-006767-9).

Results of a study of some gravity-sensitive mechanisms and systems relevant to space flight applications are presented in a generalized manner. In particular, attention is given to convection of the gravitational and nongravitational kinds under microaccelerations, including the limiting case of theoretical zero gravity. The discussion also covers models of convective processes associated with the growth of crystals and epitaxial structures, separation of biological substances by electrophoresis, microgravity alternatives, and methods of convective process control.

A92-44062 Prediction of types of pyroxenes on the surface of bright near-earth and near-Mars asteroids (Prognoz tipov piroksenov na poverkhnosti svetlykh asteroidov, priblizhaiushchikhsia k zemle i Marsu). D. I. SHESTOPALOV and L. F. GOLUBEVA, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 26, No. 2, Mar.-Apr. 1992, pp. 77-88. 12 Refs.

Colorimetric data of bright near-earth and near-Mars asteroids from TRIAD and ECAS are analyzed. Composition fields of pyroxenes were obtained for these asteroids from the value of the u-x color index and the ferrous absorption band position near 505 nm within the pyroxene quadrilateral. Pyroxenes of the S asteroids from the Apollo-Amur group which have spectral parameters similar to achondrites may be represented by the diopside-augite series. AA asteroids (S type), whose spectral parameters are similar to L-chondrites, have either a chondritic composition or Fe-rich orthopyroxenes and clinopyroxenes that are not encountered in meteoritic minerals. It is found that the average u-x color index increases with increasing average perihelion distance from 1 to 1.8 AU, which indicates the dependence of the chemical composition of pyroxenes on the surface of bright asteroids on this distance.

A92-44060 Chemistry of the surface and lower atmosphere of Venus (Khimia poverkhnosti i nizhnai atmosfery Venery). B. FEGLEY, JR., and A. TREIMAN, National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX. *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 26, No. 2, Mar.-Apr. 1992, pp. 3-65. Research supported by Lunar and Planetary Institute, Max-Planck-Gesellschaft zur Foerderung der Wissenschaften, National Research Council, and NASA. 218 Refs.

A comprehensive overview of the chemical interactions between the atmosphere and surface of Venus is presented. Earth-based, earth-orbital, and spacecraft data on the composition of the atmosphere and surface of Venus are presented and applied to quantitative evaluations of the chemical interactions between carbon, hydrogen, sulfur, chlorine, fluorine, and nitrogen-containing gases and possible minerals on the Venus surface. The calculation results are used to predict stable minerals and mineral assemblages on the Venus surface to determine which, if any, atmospheric gases are buffered by mineral assemblages on the surface, and to critically review and assess prior work on atmosphere-surface chemistry on Venus. It is concluded that the CO₂ pressure on Venus is comparable to the CO₂ equilibrium partial pressure developed by the calcite + wollastonite + quartz assemblage at the mean Venus surface temperature of 740 K.

A92-32007 Is the analysis of the observational data from the Viking-1 and -2 space vehicles on the optical characteristics of the Mars atmosphere reliable? (Dostoveren li analiz nabliudatel'nykh dannykh kosmicheskikh apparatov 'Viking-1 i -2' ob opticheskikh svoistvakh atmosfery Marsa?). A. V. MOROZHENKO, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 26, Jan.-Feb. 1992, pp. 28-38. 25 Refs.

Data on the optical properties of the Martian atmosphere and the nature of its high transparency obtained on the basis of observations from the Viking-1 and -2 have been analyzed. The analysis indicates that the values obtained for the effective radius of particles do not agree with the results of polarimetric observations, and that, in periods when images of the sun were obtained, the optical properties of the planet's atmosphere were unstable. It is contended that, since the latter was not taken into consideration when the Viking observations were processed, it can be concluded that the above data on the optical properties of the Martian atmosphere are erroneous.

A92-26016 Biocatalysis using immobilized cells or enzymes as a method of water and air purification in a hermetically sealed habitat (Biokataliz na osnove immobilizovannykh kletok ili fermentov kak odin iz podkhodov k ochistke vody i atmosfery v obitaemo germob'ekte). T. E. LEBEDEV, N. M. NAZAROV, and IU. E. SINIAK, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 42-45. 19 Refs.

The feasibility of using, in a regenerative life support system, immobilized cells to purify water and air in hermetically sealed habitats is discussed. Consideration is given to various methods for immobilizing bacteria that are selected for their adaptive abilities to assimilate organic components that need to be removed, and the suitable substances that can serve as the carriers for immobilized bacteria and enzymes. Particular attention is given to the use of denitrification bacteria immobilized on mineral carriers. The purification technique discussed here is of relevance to long-duration space missions, particularly for the flights to Mars.

A92-26035 The interior structure of the giant planets (Vnutrennee stroenie planet-gigantov). V. N. ZHARKOV, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 25, Nov.-Dec. 1991, pp. 627-649. 35 Refs.

An overview of the principal ideas and data pertaining to the construction of models of the interior structure of Jupiter, Saturn, Uranus, and Neptune is presented. Topics discussed include: the concept of Jupiter and Saturn as planets with hydrogenic crusts; the theory of the figure of rotating planets in hydrostatic equilibrium; a gas-liquid dynamic model of the giant planets; analysis of observational data; abundances of elements and groups of cosmochemical substances; equations of state; and the role of Jupiter in the formation of the earth and the giant planets.

A92-26026 The composition, structure, and gravitational field of Mars (Sostav, stroenie i gravitatsionnoe pole Marsa). V. N. ZHARKOV, E. M. KOSHLIAKOV, and K. I. MARCHENKOV, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 25, Sept.-Oct. 1991, pp. 515-547. 50 Refs.

Various aspects of the interior structure of Mars, including the chemical composition and a petrological model of the planet, are considered. This model of Mars is divided into three basic regions: the crust, the mantle, and the core. The crust thickness may approach 150-200 km. The depth of the core-mantle boundary is 1600 \pm 200 km. The Martian core may be in a liquid state. The Green function method is used to interpret the gravitational field. The stress level in the Martian lithosphere is several hundred bars. The value of the stresses in the mantle is about 30 bars.

A92-26018 Assessment of the health status and the characteristics of metabolism in cosmonauts during a prolonged space flight (Otsenka sostoiianiia zdorov'ia i osobennostei obmena veshchestv u kosmonavtov v usloviakh dlitel'nogo kosmicheskogo poleta). A. I. GRIGOR'EV, V. V. POLIAKOV, V. B. NOSKOV, and V. I. KOZHARINOV, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 48, 49. 6 Refs.

The effect of a long-term (up to 200 days) space flight on the biochemical indices of cosmonauts' blood was investigated using minute quantities of blood drawn from the finger tip of the subjects and analysis by means of special diagnostic strips and an instrumental system (Refiotron) that was adopted to the conditions of space flight. The results of microanalyses were correlated and were used to assess the conditions of metabolism and to make diagnoses of metabolic abnormalities in the myocardium, liver, pancreas, and other organs.

A92-26006 Hematologic indices in cosmonauts during a space flight (Gematologicheskie pokazateli u kosmonavtov v usloviakh kosmicheskogo poleta). M. P. KALANDAROVA, V. V. POLIAKOV, I. B. GONCHAROV, and L. I. TIKHONOVA, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 11-14. 4 Refs.

The effect of space flight on hematologic indices of the space crew was investigated in crew members of the third and the fourth prime crew flights (EO-3 and EO-4). It was found that hematological parameters in the subjects were not affected by the space flight, indicating the intactness of the blood regeneration system during these periods. However, some changes were recorded in the numbers of neutrophils, myelocytes, and lymphocytes; also observed were erythrocytic hypochromia and anisocytosis. A comparison of the results of preflight and postflight bone-marrow examinations revealed slight increases in lymphocytosis, monocytosis, and plasma-cell counts as a result of space flight.

A92-26005 Investigation of mental work capacity of cosmonauts aboard the Mir orbital complex (Issledovanie psikhicheskoi rabotosposobnosti kosmonavtov na orbital'nom komplekse 'Mir'). K. K. IOSELIANI, A. L. NARINSKAIA, SH. R. KHISAMBEEV, and G. RADKOVSKI, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 8-11. 18 Refs.

In the framework of the Prognoz experiment, changes in the mental performance occurring after 3 to 5 days of stay aboard Mir and 190 days after the mission, were evaluated in four cosmonauts visiting the station, using a computer-based psychodiagnostic unit Plevan-87. Mental performance was estimated from the ability of the subject to quickly solve the following problems: continuous counting in optimal, prescribed, or self-regulated rhythm; a complex sensorimotor reaction having psychological feedback; a conditional motor reaction to several combinations of color stimuli; and a reaction to a moving object. Results demonstrated the ability of the Plevan-87 system to provide reliable predictions concerning the mental work capacity of cosmonauts. All subjects demonstrated high mental stability during and after the flight.

A91-32361 An engineering model of the Mars atmosphere for the Mars-94 project (MA-90) (Inzhenernaia model' atmosfery Marsa dlia proekta Mars-94 /MA-90/). B. I. MOROZ, V. V. KERZHANOVICH, and V. A. KRASNOPOL'SKII, *Kosmicheskii Issledovaniia* (ISSN 0023-4206), Vol. 29, Jan.-Feb. 1991, pp. 3-84. 59 Refs.

The MA-90 engineering model for the Mars-94 project, the Soviet mission to Mars planned for 1994, is described. The project includes an orbiter and a set of descent modules (balloon, small stations, penetrators, and a small rover). The balloon has been shown to be the module that would be the most sensitive to the atmosphere below 10 km. Diverse data pertaining to the development of the Mars-93 project and the MA-90 model are presented.

A92-26004 External respiration and gas exchange during space flights (Vneshnee dykhanie i gazoobmen v kosmicheskikh poletakh). V. M. BARANOV, M. A. TIKHONOV, N. M. ASIAMOLOVA, M. I. VOLKOV, A. N. KOTOV, G. E. SAVCHENKO, and K. S. KHAIDAKOV, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Nov.-Dec. 1991, pp. 4-8. 48 Refs.

Using results obtained in earlier space flights and simulated flight studies, the effects of microgravity, acceleration, and changes in the composition and pressure of the spacecraft-cabin and the space suit atmospheres on the parameters of the respiratory function of humans are examined. It is shown that the effects include changes in the respiration biomechanics, the gas-diffusion and ventilation-perfusion ratios in lungs, the regulation of respiration and of respiratory muscles, the degrees of the hydration and blood filling of lungs, and the acid-base equilibrium and blood gases. In addition, a combination of these effects may cause functional and morphological changes in the lung tissue.

A92-25272 Development of new technology for conducting computer-controlled complex medical investigations aboard Mir within the framework of the Shipka project (Sozdanie novoi tekhnologii provedeniia i realizatsii upravliaemykh avtonomnykh kompleksnykh meditsinskikh issledovaniia na borte stantsii 'Mir' po proektu 'Shipka'). R. D. NEDKOV, V. M. SHALAMANOV, S. D. SIMEONOV, S. K. TANEV, V. I. KOZHARINOV, and V. V. BOGOMOLOV, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Sept.-Oct. 1991, pp. 56-58. 4 Refs.

The technology of conducting computer-controlled neurophysiological and psychophysiological studies during the Soviet-Bulgarian Shipka project aboard Mir is discussed. The Shipka project includes the following experiments: (1) the Labirint experiment, for studying mechanisms of the development of deficiencies in the relationship between the vestibulatory and the visual systems due to space flight; (2) the Statokinetika experiment, for studying the mechanism of the body-position regulation; (3) the Potential experiment, for studying the condition of excitable muscle-fiber membranes; and (4) a study of the characteristics of psychological adaptation in individual cosmonauts by means of a questionnaire, and of the effects of relaxation and entertainment on the psychological adaptation. Block diagrams of the experimental software support are presented.

A92-25262 The effect of weightlessness on healing of bone fractures in rats flown on the Cosmos-2044 biosatellite (Vliianie nevesomosti na zashivlenie perelomov kostei u kryss, eksponirovannykh na biosputnike 'Kosmos-2044'). G. N. DURNOVA, T. E. BURKOVSKAIA, E. V. VOROTNIKOVA, A. S. KAPLANSKII, and O. V. ARUSTAMOV, *Kosmicheskaiia Biologiia i Aviakosmicheskaiia Meditsina* (ISSN 0321-5044), Vol. 25, Sept.-Oct. 1991, pp. 29-33. 26 Refs.

The effect of microgravity on the healing characteristics of bone tissue was investigated in rats flown aboard Cosmos-2044, two days after the animals underwent an operation in which their fibulae were cut bilaterally. Results of histological and histomorphometrical examinations showed that healing was inhibited; bone callus was underdeveloped and the bone fragment consolidation was inadequate. The newly formed bone tissue exhibited increases in the relative volume of osteoid and a decrease in the number and activity of osteoblasts, signs of mineral disorders. Similar results were observed in rats exposed to tail suspension.

A92-21674 Global space power engineering (Global'naia kosmicheskaiia energetika). L. A. LATYSHEV and N. N. SEMASHKO, *Akademiiia Nauk SSSR, Izvestiia, Energetika i Transport* (ISSN 0002-3310), Nov.-Dec. 1991, pp. 16-23. 14 Refs.

The power requirements of the mankind are evaluated, and ecological limits on power production on earth are discussed. The advantages of space-based power generation are demonstrated, and various methods of implementing space power production are examined with reference to the existing prototypes of solar and fusion energy converters. The need for a systematic study of problems associated with power generation in space is emphasized.

A91-23992 Investigation of the work of the founders of astronautics and its contemporary problems (Issledovanie tvorchestva osnovopolozhnikov kosmonavtiki i ee sovremennye problemy). B. V., RAUSHENBAKH, ED. *Izdatel'stvo Nauka*, 1989, 178 pp. (No individual items are abstracted in this volume).

The scientific work of the 'founders' of astronautics in the Soviet Union is described, with particular emphasis on Blagonravov, Babakin, and Bushuev. Consideration is then given to various current problems in astronautics, including: spacecraft and rocket design; engine theory and design; power systems and electrorocket engines; and applied celestial mechanics and motion control.

A91-23962 Instrumentation and methods for space exploration (Apparatura i metody issledovaniia kosmicheskogo prostranstva). V. M. BALEBANOV, ED. *Izdatel'stvo Nauka*, 1989, 240 pp. (For individual items see A91-23963 to A91-23989).

Instrumentation for investigations in the areas of space plasma physics, high-energy astrophysics, and the physics of planets and planetary atmospheres is described. Particular attention is given to the development and ground testing of such systems as the Phobos probe, the Rentgen astrophysical module on the Mir station, and the Granat astrophysical observatory.