

Soviet and Japanese Aerospace Literature

Throughout 1989 the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet 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 *The Human Factor in Space Sciences* from the USSR and Japan.

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Soviet Aerospace Literature This month: *The Human Factor in Space Sciences*

A88-36010 Effect of translational relocations on some characteristics of heat exchange in humans (Vliianie transshirotnykh peremeshchenii na nekotorye pokazateli teploobmena u cheloveka). G M DIVERT and S G KRIVOSHCHIEV, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, Mar-Apr 1988, pp 231-236. 10 Refs

The effect of a translational relocation on the heat exchange system of humans was investigated in six subjects flown from Novosibirsk to Frunze (where the average temperature was about 10-15 C higher) and, two weeks later, back to Novosibirsk. Parameters characterizing the status of the heat exchange system were measured before flight, 2 days and 2 weeks after arrival, and 2 days after return, when subjects were at rest and doing physical work at two temperatures of the constant-temperature chamber 26 and 13 C. It was found that, upon relocation, subjects exhibited both nonspecific thermoregulating responses (i.e., responses not depending upon the sign of climatic contrast), which manifest themselves at 26 C, and specific responses, which are manifested at 13 C. As a nonspecific response, subjects exhibited an increase of mean surface temperature, a decrease in sensitivity to cold, and a decrease of temperature gradient between the core and surface temperature. Among specific responses measured at 13 C were the changes in the mean skin temperature (an increase in hot climate and a decrease in cold) and changes in the core-surface temperature gradients.

A89-16644 Estimating the resistance of the human organism to physical and thermal loads and its thermal adaptability (Otsenka ustoychivosti organizma cheloveka k fizicheskoi i teplovoi nagruzke i ego termoadaptivnosti). O S GORETSKII, V A MAKSIMOVICH, and V A MAL'TSEV, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, Sept-Oct 1988, pp 823-826. 12 Refs

This paper describes the criteria and the methods developed for estimating the physiological stability and thermal adaptability of humans on the basis of correlations between the indexes of the organism's functional state and its reactivity to high temperatures and humidity. The functional state of subjects performing physical work in a high-temperature chamber (40 C and 85-90 percent humidity) was estimated from an analysis of changes observed in the functions of cardiovascular, nervous, and respiratory systems and of the water and salt metabolism, the indexes of thermostability and thermoadaptability were calculated using appropriate equations. It was found that subjects with low values of the thermostability index (most northerners) but high values of thermoadaptability are able to adapt to work in a high-temperature climate. Subjects with low levels of the thermoadaptability index are not likely to adapt to life at high temperatures, it is recommended that these subjects should not change climate.

A88-43101 Endocrinal regulation during various pathological conditions and under the influence of extreme factors (Endokrinnaia regulatsiya pri razlichnykh patologicheskikh sostoyaniyakh i vozdeystvii ekstremal'nykh faktorov). G M IAKOVLEV, V I MAZUROV, V A IAKOVLEV, A L RAKOV, K V KULAGIN et al., *Voenno-Meditsinski Zhurnal* (ISSN 0026-9050), April 1988, pp. 35-37. 6 Refs

The hormonal responses of humans to stressful pathological conditions such as severe burns, mechanical trauma, and myocardial infarct and to environmental stress, such as physical loads, hypodynamia, high altitude, and high-latitude climate, were investigated. Hormonal changes were determined by periodically measuring (using radioimmunoassays) blood concentrations of various hormones during stress and after the removal of stressful conditions. It was found that both physical and environmental stress factors acted by increasing the activity of the hypothalamic-hypophyseal-adrenal system and decreasing the activity of the hypothalamic-hypophyseal-gonadal system, although the degree of hormonal changes varied with the type of stress. Maximal deviations were observed during life-threatening stress such as mechanical trauma and severe burns. Moreover, the hormonal deviations lingered for some time after the removal of stress.

A88-32134 Individual and typological characteristics of auditory response to an acoustic stimulus as determined from mean evoked potentials in the cortex of healthy subjects (Individual'no-tipologicheskie osobennosti otrazheniya intensivnosti akusticheskogo stimula v usrednennykh vyzvannykh potentsialakh mozga zdorovykh ispytue-mykh). V G KAMENSKAIA, L V TOMANOV, and I A RAKHUBA, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, Jan-Feb 1988, pp 65-75. 14 Refs

The relation between the type of personality (extrovert vs introvert) and the character of the cortical response to acoustic stimuli of different intensity was investigated in 16 healthy individuals. The subjects were evaluated with respect to their personality, using Eysenck's questionnaire, and with respect to attentiveness (characterized by the ability to concentrate and the stability of concentration), using methods described by Urbakh (1964). The auditory tests consisted in testing signal counting correctness, measuring the time of reaction to a command signal, and recording cortical potentials evoked by 20-db, 10-db, and threshold-intensity sounds. It was found that the values of the late components of mean evoked potentials, N2 and P3, change in response to acoustic stimuli in a manner which is different for extroverts from that of introverts and which corresponds to the dynamics of mental concentration in individual subjects.

A88-55334 Main results of medical investigations during long-duration space flights onboard Salyut-7 - Soyuz-T. O. G. GAZENKO, A. I. GRIGOR'EV, and A. D. EGOROV, *IAF, 39th International Astronautical Congress*, Bangalore, India, Oct. 8-15, 1988. 7 pp. 16 Refs. (IAF Paper 88-074)

Medical investigations conducted during six long-term missions (65 to 237 days) and five short-term missions (8 to 12 days) between 1982 and 1986 on the orbital complex Salyut-7-Soyuz-T are discussed. The flight parameters of Salyut-7 are presented including the environmental parameters, diet, water supply, work and rest arrangements, and exercise habits. Results are presented from experiments concerning cosmonauts' health status, nervous responses, sleep, and work capacity. Decreases in body mass and leg volume, and changes in vestibular function, motor activity, and the cardiovascular system are reported. The fluid-electrolyte metabolism and hormonal status of the cosmonauts are given, including an increase in the production of ADH and aldosterone, activation of the sympathoadrenal, cholinergic and histaminergic systems, and inhibition of the serotonergic system. Experiments on bones, immunology, and extravehicular activity are also presented.

A89-16645 Fatigue problems of flight personnel (Concepts, causes, symptoms, classification) (Problemy utomleniya letnogo sostava/Poniatia, prichiny, priznaki, klassifikatsiia). V. A. BODROV, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, Sept.-Oct. 1988, pp. 835-843. 51 Refs.

The concepts defining fatigue and overfatigue in flight personnel are discussed together with the causes of these phenomena and their symptoms. It is noted that, at present, there is no single system for defining symptoms of overfatigue and for its diagnosis. This is due to the fact that the effects of various factors causing overfatigue are accompanied by many nonspecific symptoms which can characterize one or more other functional conditions, in addition, the fatigue phenomenon induces reactions of compensation and adaptation, which may be manifested as both a slow-down and an activation. Complex factors that have to be considered in the evaluation of the fatigue syndrome in pilots are discussed.

A89-10747 Dynamics of cytochemical indexes in the blood of flight personnel (Dinamika tsitokhimicheskikh pokazatelei krovi u letnogo sostava). P. S. PASHCHENKO, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), July 1988, pp. 55-57. 7 Refs.

The effects of the pilot's age, total accumulated flight time, and the length of service on the contents of some of the white blood cell enzymes were investigated in a group of highly qualified pilots, using cytochemical techniques to quantify the cell constituents in the pilots and in a group of ground-based personnel. It was found that the age-induced changes in various cytochromic parameters, especially lipids and glycogen, were aggravated by the accumulation of flight time. In some pilots with more than 1500 hours of flight time, fat droplets were observed on the surface of red blood cells, together with abnormally large amounts of fat deposits inside leucocytes. The contents of two mitochondrial enzymes, succinate dehydrogenase and cytochrome oxidase, correlated negatively with flight time.

A88-48726 Means of maintaining the work capacity of humans using individual protective facilities (Puti sokhraneniia rabotosposobnosti liudel, nakhodiaschchikhsia v sredstvakh individual'noi zashchity). I. U. G. PLETENSKII, P. B. MARKELOV, A. I. U. NEFEDOV, and M. I. KHARCHENKO, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), May 1988, pp. 45-47. 23 Refs.

This paper considers methods for maintaining the work capacity of humans wearing protective suits (designed as a safeguard against radioactive or chemical substances), alone or in combination with ventilation and/or artificial skin-wetting systems. Both of these artificial thermoregulatory systems were demonstrated to be effective in an elevated-temperature environment. However, the nonautonomous character of these systems limits their applicability under normal-gravity on-ground conditions. The regulation of work-rest sequences is, at present, the most accessible method for the prevention of hyperthermia inside protective suits and for the maintenance of work capacity.

A88-44208 The possibilities of increasing human tolerance to acute hypoxia after adaptation to high altitude and quick high-altitude training (Vozmozhnosti povysheniia ustoiichivosti cheloveka k ostroi gipoksii posle vysokogornoi adaptatsii i vysotnoi ekspress-trenirovki). A. I. U. KATKOV, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, May-June 1988, pp. 441-445. 7 Refs.

The limits of human tolerance to acute hypoxia (measured by the degree of the stability of various cardiovascular and respiratory parameters) were tested in trained mountain climbers and in subjects who have undergone three-day-long training in a pressure chamber at altitudes equivalent to 5000-9000 m, using regimens of exercise and rest described by Katkov et al (1982) and Kovalenko et al (1985), respectively. The mountain climbers were divided into three groups according to the altitudes of their permanent residence and of the ascent, and to the length of adaptation to higher altitudes. It was found that the stability of the measured physiological parameters was significantly higher in mountain climbers (even 5-6 months after the last ascent) than in subjects trained in the pressure chamber. Within the altitude range of 5621-8848 m, the altitude of the ascent was not a factor.

A88-44204 Vegetative reactions during mnemonic activity in humans with different levels of the functional speed of neural processes (Vegetativnye reaktsii pri mnemicheskoi deiatel'nosti u liudel s razlichnym urovнем funktsional'noi podvizhnosti nervnykh protsessov). N. V. MAKARENKO, V. I. VORONOVSKAIA, and L. I. LIMAN-SKAIA, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, May-June 1988, pp. 355-363.

The relationship between memory productivity and the measures of vegetative reactions accompanying mnemonic activity was investigated in human subjects with different levels of the functional speed of neural activity. The measure of this functional speed was the threshold frequency of visual stimuli at which the subject could differentiate verbal stimuli with an error not above 5 percent. It was found that humans differing in the level of the neural-activity speed also differed in the productivity of memory and in the vegetative reactions evoked by the mnemonic process. Subjects with high speed of neural activity exhibited lower background values of heart rate (HR) and higher HR during the mnemonic test, compared with subjects of below-average neural activity speed. Subjects with a low speed of neural activity exhibited lower respiration rate (RR) in the control state and high RR during mnemonic activity.

A88-32016 Reactions of the cardiovascular system to static load in athletes and in untrained subjects (Reaktsii sistemy krovoobrashcheniia na staticheskuiu nagruzku u sportsmenov i malotrenirovannykh lits). M. A. VODOP'ANOVA, N. V. DROBOTIA, and G. S. KARAPETIAN, *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), Vol. 74, Feb. 1988, pp. 294-299. 17 Refs.

The effect of physical training on the cardiovascular system was investigated by measuring cardiovascular responses to a static load (a 3-kg load held with the arm outstretched) in untrained subjects (group 1) and in trained cyclists (group 2). In the group-1 subjects, the effect of the load included increases in systolic output, pulse rate, minute blood volume, rate of pulse wave propagation, and mean hemodynamic pressure. In the group-2 subjects, the load-induced responses also increased the pulse rate, minute blood volume, and mean hemodynamic pressure, however, the systolic output and peripheral vasoconstriction indices were decreased, indicating a reaction of energy economy. It is suggested that the increases in the systolic output, the rate of pulse-wave propagation, and the mean hemodynamic pressure can serve as criteria for predicting the degree of fatigue.

A88-31190 Safety aspects of human factors on aircraft design. L. M. BERESTOV and A. N. STEPANENKO, *ICAO Bulletin* (ISSN 0018-8778), Vol. 43, Feb. 1988, pp. 25-28.

The USSR airworthiness regulations give intensive attention to the 60-70-percent extent to which serious aircraft accidents are associated with the negative influence of the human factor. Statistical analyses have established that typical human errors occur under both normal and adverse operating conditions; they are, however, more severe and consequential when functional systems fail or when the pilot is exposed to severe external stress. A statistical modeling plan flowchart is presented for consideration of the various adverse factors.

A87-42163 Diagnosing coronary insufficiency in flight personnel (O diagnostike koronarnoi nedostatochnosti u letnogo sostava). V. I. KOLEDENOK, A. K. KOCHETOV, and N. A. LYSOGOR, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Jan. 1987, pp. 42-45. 9 Refs.

Results obtained by using the orthostatic and the voluntary hyperventilation tests for diagnosing coronary insufficiency in flight personnel were compared with results of bicycle ergometer tests performed after intake of obsidan or nitroglycerin. Subjects included 95 men who have exhibited, during the submaximal load tests, a lowering (by more than 1 mm) of the EKG ST segment. It is shown that only when all three load tests are used is it possible to separate ischemic changes appearing on the EKG during the bicycle ergometry from the false positive results obtained sometimes in the orthostatic or the hyperventilation tests. The shape of the ST segment displacement and the proportionality of the degree of this displacement to the load magnitude are of major importance in diagnosing the ischemic condition.

A88-54005 Space biology and medicine (Russian book) (Kosmicheskaya biologiya i meditsina). O. G. GAZENKO (ed), Moscow, Izdatel'stvo Nauka, 1987, 320 pp.

This book examines the reactions of the human organism to the adverse conditions of space flight, the functioning of life support systems, and the means of maintaining the health and work capacity of cosmonauts. Topics discussed include the effects on humans of the space-flight dynamics; the mechanism of the weightlessness effect and the protective measures, the psychological reliability of the cosmonaut during a space flight and the psychological preparation and support; the habitability of the spacecraft cabin, the physiological-hygienic and ergonomic aspects of the spacesuit design and the medical and biological results of EVA activity, protection against cosmic rays, and the preparation of a cosmonaut for survival after a nonscheduled landing in such areas as the Arctic, taiga, desert, or jungles, or on the ocean. Special attention is given to the medical support of cosmonauts, the methods used for their selection and preparation, and medical assistance during a spaceflight. Various aspects of biological experimentation in space are discussed, including the selection of animals and microorganisms for experiments, and the maintenance of these organisms in space. Results on biological studies in space are included.

A88-27144 The possibilities of the perception and processing of complicated speech information by an operator (O vozmozhnostyakh vospriyatiia i pererabotki operatorom slozhnoi rechevoi informatsii). G. I. TARASENKO, G. E. SHCHERBACHENKO, and I. A. PETLENKO, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Oct 1987, pp. 48, 49

This paper considers the conditions under which a crewmember can isolate emergency stand-by commands from a stream of general information in the presence of intense acoustic interference. In the experiments, trained aircraft operators were asked to correctly identify warning-type commands (WCs) given (by means of a head phone) by a female voice simultaneously with general information messages (IMs) presented by a male voice. The commands and messages were presented with or without background noise. In the second series, a 'vocal cocktail' was used, when the simultaneous presentation of the WCs and IMs was superimposed by 'speech tables'. The results of these studies indicate that the efficiency of the WC perception depends upon the intensity and frequency characteristics of the commanding voice. Training had a significant effect, however, when subjects were trained in the absence of background noise, the effect of training was nullified upon the introduction of 105-110 dB noise.

A88-21902 Procedural approaches for detecting hyperlipemia in flight personnel (Metodicheskie podkhody k vyivleniiu giperlipidemii u letnogo sostava). S. A. BUGAROV, R. K. KISELEV, V. E. POTKIN, T. A. ORLOVA, V. I. PLAKHATNIUK et al., *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Sept 1987, pp. 48, 49.

The definition of the state of hyperlipemia in a subject depends upon the norms set for the control levels of atherogenic plasma lipoproteins. A relationship is proposed for the determination of the coefficient of atherogenicity, which expresses the ratio between the contents of atherogenic and nonatherogenic lipoproteins, i.e., the ratio between the low-density and high-density cholesterol fractions. This relationship was used to analyze the status of lipid metabolism in 44 pilots in the 23-41 yr bracket, comparing the results with those of two conventional methods (comparisons of individual cholesterol values with its upper limits or with the age-normalized 'proper' levels). Using the coefficient of atherogenicity, hyperlipemia was diagnosed in 21 subjects, only seven subjects were diagnosed hyperlipemic by all three methods used.

A88-54007 Medical investigations results obtained in 125-day flight on 'Salyut-7' and 'Mir' orbital stations. A. EGOROV, O. ANASHKIN, O. ITSEKHOVSKII, I. ALFEROVA, L. GOLUBCHIKOVA et al., *Physiologist, Supplement* (ISSN 0031-9376), Vol. 31, Feb 1988, pp. S-1 to S-3.

The results of medical experiments and monitoring performed on a long-term Soviet space mission in 1986 are summarized. Topics addressed include monitoring during normal operations and EVAs, in-depth medical examinations in the resting state, functional tests, metabolic and regulatory experiments, environmental monitoring, and evaluation of proposed prophylactic measures against the adverse effects of weightlessness. Although the cosmonauts were generally healthy throughout the mission, several significant cardiovascular changes were recorded, including redistribution of fluid and general deconditioning. Numerical data on these changes are presented in tables and briefly characterized.

A88-39920 The possibilities of the correlational rhythmography method for the assessment of pilots' preflight condition (Vozmozhnosti metoda korreliatsionnoi ritmografii v otsenke predstartovogo sostoiianiia letchikov). G. N. GRECHIKHIN, V. G. DOROSHEV, and V. V. GRISHCHENKO, *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), March 1988, pp. 36-38.

Correlational rhythmography (CRG), widely used in clinical diagnostics for testing the quality of heart-rhythm (HR) regulation, was used to assess the physiological condition of pilots shortly (1-1.5 h) before a flight. The experimental group included 50 group-1 and group-2 pilots aged 27-36, who were previously admitted to flight activity without limitations. The results of the rhythmogram analysis showed normal sinusoidal rhythm in 70.6 pilots. One pilot exhibited sinusoidal isorhythmia (with no subjective complaints); a subsequent ECG examination indicated a history of a minor infarct of the left ventricle, which occurred two weeks before the flight and which was not diagnosed at the time due to the absence of typical symptoms. Pilots with rigid rhythms were also found to exhibit abnormalities of the circulation system, as indicated by ECG examinations. It is concluded that the CRG method can be used as a rapid routine control for pilots assigned to flight duty.

A88-37706 Biomedical and social/psychological problems connected with space flight and the investigation of extreme environments on earth: A bibliography of Soviet and non-Soviet literature for 1971-1975 (Russian book) (Mediko-biologicheskie i sotsial'no-psikhologicheskie problemy osvoiniia kosmosa i regionov zemli s ekstremal'nymi usloviiami sushchestvovaniia: Ukazatel' otechestvennoi i zarubezhnoi literatury 1971-1975). N. N. MIKHAILOVA, E. A. AKHUTIN, S. P. FINOGENOVA, V. P. ALEKSEEVA, and M. L. SHVARTS, Moscow, Izdatel'stvo Nauka, 1987, 602 pp.

This bibliography on the biomedical and social/psychological aspects of space flight and the study of extreme (polar, arid, and mountain) environments on earth (analogous to certain space flight conditions) contains nearly 7000 entries. The cited works treat such issues as the effect of space flight factors on biological organisms, life support systems, and astronaut selection and training. A name index is provided.

A88-12435 Physiological investigations of primates onboard biosatellites Cosmos-1514 and Cosmos-1667. O. G. GAZENKO and E. A. ILL'IN, (International Union of Physiological Sciences, Commission on Gravitational Physiology, 8th Annual Meeting, Tokyo, Japan, Nov 4-8, 1986) *Physiologist, Supplement* (ISSN 0031-9376), Vol. 30, Feb 1987, pp. S-31 to S-35. 12 Refs.

The development of the space adaptation syndrome was studied in four rhesus monkeys flown aboard the Cosmos-1514 (5-day flight) and Cosmos-1667 (7-day flight) in 1983 and 1985, respectively. It was found that at an early period of adaptation, the excitation of vestibular neurons connected with the semicircular canals and the otoliths increases. No significant variation of the blood flow velocity in the common carotid artery was revealed. It was concluded that the cause of unpleasant sensations reported by cosmonauts in the early stages of flight, such as head heaviness and blood rush to the head, is caused not by an increased arterial flow to the upper body but by some other mechanism or factor. It is suggested that the outflow of the venous blood and the cerebrospinal fluid might become hampered. By the end of 5-7 days in weightlessness, most parameters under study tended to return to normal.

A88-12973 Metabolic and hormonal status of crewmembers in short-term spaceflights. A. I. GRIGOR'EV, I. A. POPOVA, and A. S. USHAKOV, (NASA, Universities Space Research Association, Baylor University, and International Academy of Astronautics, 7th International Man in Space Symposium, Houston, TX, Feb 10-13, 1986) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 58, Sept 1987, pp. A121-A125. 11 Refs.

In order to clarify biochemical adaptation of the human body to short-term microgravity, metabolic and hormonal parameters were investigated in 20 cosmonauts who performed orbital flights of 4 to 14 d in duration. The specific feature of adaptation to this exposure is the transition to a new level of hormonal regulation with a significant increase of the content (production) of glucocorticoids, catecholamines, components of the renin-angiotension-aldosterone system (which determines a modified activity of tissue hormones), and fluid-electrolyte homeostasis, as well as simultaneous increase of insulin secretion (which diminishes the metabolic effects of glucocorticoids and catecholamines).

A88-50762 Elements of aviation psychology (Russian book) (Osnovy aviatsionnoi psikhologii). KONSTANTIN KONSTANTINOVICH PLATONOV and BORIS MARKOVICH GOL'DSHTEIN, Moscow, Izdatel'stvo Transport, 1987, 224 pp. 32 Refs.

The goals and the methods of aviation psychology are considered. The book includes chapters on the cognitive signals of psychological processes (such as sensation, perception, memory, imagination, illusion, thought, and speech) that can be recorded in pilots during flights, on the characteristics of the pilot's emotional and volitional processes, and on the pilot's psychological characteristics, such as temperament, character, and personality traits. Special attention is given to tests of piloting abilities and to psychological tests used in selecting future pilots, to the effects of the pilot's individual sensitivity to biorhythm desynchronizations, and to the effects of psychological problems of individual pilots on safety. The methods used in the psychological training of pilots are discussed.

A88-50647 Periodization and classification of the adaptation reactions of the human organism in the course of long-time space flights (Periodizatsiia i klassifikatsiia prispособitel'nykh reaktsii organizma cheloveka v dlitel'nykh kosmicheskikh poletakh). O. G. GAZENKO, A. I. GRIGOR'EV, and A. D. EGOROV, *IN Stress-development mechanisms* (A88-50645 21-51) Kishinev, Izdatel'stvo Shtiintsa, 1987, pp. 33-52. 30 Refs.

The paper discusses mechanisms responsible for the development of the physiological syndrome induced by weightlessness, which is the major factor of space-specific disorders. Attention is given to the physiological shifts that take place under conditions of weightlessness, the functional disorders caused by these shifts, and the adaptive physiological changes that partially counteract the effect of weightlessness during long flights. Evidence is presented for the ability of the human body to adapt to conditions of weightlessness (and, upon return, to readapt to normal-gravity conditions), making it possible for the spacecraft personnel to perform their work routines and to remain in space for as long as seven months. It was found that the magnitudes of the adaptive changes varied according to different prophylactic regimens adopted during the flight and thus did not show a direct relationship with the duration of different flights.

A88-29105 Man in space: 25 years of manned space flights in the Soviet Union - Biomedical aspects. ANATOLII I. GRIGOR'EV and INESSA B. KOZLOVSKAIA, *IN: Biological sciences in space 1986; Proceedings of the 1986 International Symposium, Nagoya, Japan, Nov. 10-12, 1986* (A88-29103 11-51) Tokyo, MYU Research, 1987, pp. 9-16.

Primary weightlessness-induced physiological disorders that appear soon after exposure to the conditions of space flight are identified, and measures used to maintain good health condition and high work capacity of crewmembers during prolonged space flights are discussed. Among these measures are taking countermeasures against specific symptoms and providing adequate and comfortable environment, rational work and rest cycle, sufficiently long sleep, and well balanced nutrition. Of great importance is also the proper selection of individual crew members and the proper balance of crews, as well as their physical, professional, and medical training.

A87-41954 Effect of crew motions on the spatial position of a spacecraft (O vliianii dvizheniia kosmonavta na prostranstvennoe polozhenie kosmicheskogo korablia). G. R. SALIMOV, *Akademiia Nauk SSSR, Izvestia, Mekhanika Tverdogo Tela* (ISSN 0572-3299), Mar-Apr 1987, pp. 20-26. 5 Refs.

Equations of motion for a spacecraft are obtained with allowance for the motions of the crew inside the spacecraft and on its outside surface. The spacecraft is modeled by a rigid body and the crew by a point mass, the motion of the crew is assumed to be known a priori. In particular cases, an analysis is made of the relationship between the angular velocity and system parameters. It is shown that when the crew moves at a constant relative velocity, the angular velocity of the spacecraft depends only on the final position of the crew. A class of possible trajectories is examined, and results of numerical calculations are presented.

A87-43687 The relationship between cellular reactions in the blood of flight personnel and some functional states of the organism (Zavisimost' kletochnykh reaktsii krovi letchikov ot nekotorykh iskhodnykh funktsional'nykh sostoianii organizma). P. S. PASHCHENKO, *Voenna-Meditsinskii Zhurnal* (ISSN 0026-9050), March 1987, pp. 45-47.

Cytochemical reactions in white blood cells on a work load of three flights per shift were evaluated in pilots grouped into three categories according to their psychophysiological state. The division, based on the type of the white-blood-cell morphological reactions to psychological stimuli, was as follows: (1) the subjects with the white-cell blood picture specific for a reaction to a weak stimulus, (2) subjects reacting by low activation to a moderate stimulus, and (3) subjects with an elevated-type of leukocyte reaction to a moderate stimulus. Compared to nonstressed subjects of the first and the second groups, the subjects of the third group displayed higher levels of cell deformation, lymphocyte and granulocyte vacuolization, lowered contents of glycogen and elevated levels of phosphorylase in neutrophils, as well as high levels of lymphocytic LDH and alpha-glycerophosphate activities. At the same time, the levels of cytochrome oxidase, succinate dehydrogenase, and G-6-P-dehydrogenase activities in lymphocytes of these subjects were decreased.

A87-50949 The problems of aircraft microclimate (Review of the literature) (Problemy mikroklimate v samoletakh /Obzor literatury/). A. N. AZHAEV, I. D. MALININ, and E. A. LUSHCHIKOV, *Voenna-Meditsinskii Zhurnal* (ISSN 0026-9050), April 1987, pp. 37, 38. 7 Refs.

The changes of temperature inside the front and back compartments of an aircraft during different stages of flight are discussed with emphasis on low-altitude flights in hot environments, which pose the particular danger of heat stress to aircraft personnel. Consideration is given to the ranges of ambient temperature necessary for the maintenance of comfort and of the ability to safely operate an aircraft during normal flight as well as during high-speed maneuvers. Special attention is given to preventive measures, such as air-conditioned clothing and clothing equipped with a portable water-cooling system.

A88-16187 Crewman rescue equipment in manned space missions - Aspects of application. G. I. SEVERIN, I. P. ABRAMOV, and V. I. SVERTSHEK, *IAF, 38th International Astronautical Congress*, Brighton, England, Oct. 10-17, 1987. 6 pp. 5 Refs. (IAF Paper 87-576).

The application of survival suits to earth-to-orbit transport vehicles, permanently orbiting space stations, and interplanetary spacecraft is discussed. Crewman activities during various emergencies are described along with the role of the suit. The features of different types of survival suits are examined.

A88-44207 The characteristics of perspiration during work hyperthermia (Osobennosti potootdeleniia pri rabochei gipertermii). A. S. PAVLOV, *Fiziologiya Cheloveka* (ISSN 0131-1646), Vol. 14, May-June 1988, pp. 434-440. 12 Refs.

The kinetics of heat accumulation and of perspiration (P) in humans were investigated in two groups of subjects (trained athletes and untrained healthy controls) after the subjects completed a continuous step-test exercise to exhaustion and after completion of an exercise scheme that included three 10-min-long periods of less rigorous muscular work separated by 3 min of rest. Perspiration was measured by electrodermal resistance. It was found that, in trained athletes, the latent period of P was almost four times shorter, the stabilization of the P level occurred sooner, and the levels of P were 29-32 percent lower than in controls. Increases in P registered after the interrupted-work experiments were significantly higher than the increases recorded during the continuous and more strenuous step-test exercise. The dynamics of the P process in all subjects did not coincide with the dynamics of body-temperature increases.

A88-44203 A view of the geosphere from space (Vzgliad na geosferu iz kosmosa). ALEKSANDR IVANOVICH LAZAREV and VITALII IVANOVICH SEVAST'IANOV, *Priroda* (ISSN 0032-874X), May 1988, pp. 46-54. 5 Refs.

The information about the geosphere that can be obtained by astronauts through visual observation from space is described. Particular consideration is given to visual observations of atmospheric fronts, cyclones, and hurricanes performed by Soviet cosmonauts in the 1960s (e.g., from Salyut-6). Also considered is the observation of geological structures (lineaments and ring structures) by Soviet cosmonauts (e.g., from Soyuz spacecraft and Salyut-3).

A88-15852 Man in space (Salyut 7 cosmonaut EVA operations). V. A. SOLOV'EV, *IAF, 38th International Astronautical Congress*, Brighton, England, Oct. 10-17, 1987. 4 pp. (IAF Paper 87-77).

Some of the EVA operations performed by the cosmonauts on Salyut 7 are described. The EVAs involved: (1) repairing the propulsion system, (2) installing additional solar cells, and (3) installing and testing a truss structure deployed on the station surface. The need for specific tools for these operations and the difficulty of the activities performed are discussed.

A88-12963 Ultrasound techniques in space medicine. O. I. U. ATKOV, V. S. BEDNENKO, and G. A. FOMINA, (NASA, Universities Space Research Association, Baylor University, and International Academy of Astronautics, 7th International Man in Space Symposium, Houston, TX, Feb. 10-13, 1986) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), Vol. 58, Sept. 1987, pp. A69-A73. 19 Refs.

Ultrasound examinations have been performed on 15 cosmonauts who have remained in orbit for flights ranging from 2.5 to 8 months in duration. Soviet researchers have combined hemodynamic assessments with parallel attempts to develop improved ultrasound techniques and equipment for use onboard space stations. These techniques and equipment are reviewed, as are findings relative to exercise effects on hemodynamic changes. In general, longitudinal echocardiographic studies have suggested that (1) few differences exist between resting preflight and on-orbit cardiac contractility measures, (2) declines in orthostatic stability after long-term flights are not due to deterioration of the myocardial functional state; and (3) lower stroke volumes and heart rate increases occurring during exertion may be considered compensatory hemodynamic resettlings rather than indications of a disturbed left ventricular contractility.

A88-43102 A method for increasing the work capacity of operators in hot climate (Sposob povysheniia rabotosposobnosti operatorov v usloviakh zharkogo klimata). A. Z. SLOBODIN, A. P. BORODAI, S. S. MARKEEVA, R. I. LIUBOMIRSKAIA, and N. N. KOVEROVA, *Voenna-Meditsinskii Zhurnal* (ISSN 0026-9050), April 1988, pp. 44-46. 6 Refs.

This paper describes the effect of a training method, which involves breathing through the complementary pulmonary volume (CPV), on the work capacity of humans. The breathing exercises acted to produce hypoxic-hypercapnic conditions concurrent with respiratory resistance. It was found that, after 20 days of exercises, subjects were able to increase their work capacity, measured using the PWC(170) test, by 12.8 percent in comparison with the pretraining values. Trained subjects also exhibited improvements in audiomotor and videomotor reactions and in the feeling of general well-being.

A88-49549 Investigation of the structure of the interpersonal interaction in a small group applicable to the problem of selecting spacecraft crews (Issledovanie struktury mezlichnostnogo vzaimodeistviia v maloi gruppe primenitel'no k zadacham komplektovaniia ekipazhei kosmicheskikh korablei). JAN TERELAK, *Postepy Astronauky* (ISSN 0373-5982), Vol. 20, no. 3-4, 1987, pp. 61-78. 13 Refs.

This paper considers psychological problems that might arise in a small group of individuals living under conditions of social isolation, using, as an example, observations made on a group of 20 members of an Antarctic research station, which included individuals of different professions and differing personalities, values, and intellectual needs. Particular attention is given to the observations concerning the psychological patterns of aggressive behavior in these conditions and to the indicators of social adaptivity. It was concluded that aggressive behavior during isolation is a behavioral pattern that is adopted by some individuals as a form of personal stimulation during prolonged periods devoid of external stimuli.

A88-29416 Fire prevention on civil aircraft (Russian book) (Protiv-pozharnaia zashchita samoletov grazhdanskoi aviatsii). VIKTOR KONSTANTINOVICH LUZHITSKII, Moscow, Izdatel'stvo Transport, 1987, 144 pp. 40 Refs.

Various aspects of fire prevention on civil aircraft are reviewed from the standpoint of flight safety assurance. In particular, the fire-hazard compartments of aircraft and the fire safety equipment and techniques used are examined. The principles governing the selection of fire safety techniques and equipment are reviewed, and typical schemes of fire alarm and fire extinguishing systems are presented. The discussion also covers the physicochemical mechanisms of combustion processes and fire extinction.

A88-19620 Restoration of work capacity in flight personnel (K probleme vosstanovleniia professional'noi rabotosposobnosti letnogo sostava). V. A. BODROV, *Voenna-Meditsinskii Zhurnal* (ISSN 0026-9050), Aug. 1987, pp. 46-48.

This paper discusses the problem of partial work capacity loss by flight personnel due to functional aberrations in the nervous and cardiovascular systems, occurring before the appearance of clinical symptoms of a disease. These functional disorders may manifest themselves in elevated irritability, fatigability, decreased tolerance to the conditions of flight, and the development of fear sensation during flight. Methods for testing the preclinical functional aberrations are suggested, and procedures directed towards the correction of such conditions are considered. These programs must include medical, psychosociological, and occupational rehabilitation programs.