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February 1993

P-79

# AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration  
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# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 208 reports, articles and other documents originally announced in January 1993 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

<i>STAR</i> (N-10000 Series)	N93-10001 — N93-13740
<i>IAA</i> (A-10000 Series)	A93-10001 — A93-12543

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1993 will be published in early 1994.

Information on availability of documents listed, addresses of organizations, and CASI price schedules are located at the back of this issue.

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# TYPICAL REPORT CITATION AND ABSTRACT

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**ACCESSION NUMBER** → N93-12195\*# Lockheed Engineering and Sciences Co., Houston, TX. ← **CORPORATE SOURCE**  
**TITLE** → **ASTRONAUT CANDIDATE STRENGTH MEASUREMENT USING THE CYBEX 2 AND THE LIDO MULTI-JOINT 2 DYNAMOMETERS Final Report**  
**AUTHORS** → AMY E. CARROLL and ROBERT P. WILMINGTON May 1992 ← **PUBLICATION DATE**  
**CONTRACT NUMBER** → (Contract NAS9-17900)  
**REPORT NUMBERS** → (NASA-CR-185679; NAS 1.26:185679; LESC-30277) Avail: CASI HC ← **AVAILABILITY SOURCE**  
**PRICE CODE** → A03/MF A01

The Anthropometry and Biomechanics Laboratory in the man-Systems division at NASA's Johnson Space Center has as one of its responsibilities the anthropometry and strength measurement data collection of astronaut candidates. The anthropometry data is used to ensure that the astronaut candidates are within the height restrictions for space vehicle and space suit design requirements, for example. The strength data is used to help detect abnormalities or isolate injuries to muscle groups that could jeopardize the astronauts safety. The Cybex II Dynamometer has been used for strength measurements from 1985 through 1991. The Cybex II was one of the first instruments of its kind to measure strength and similarity of muscle groups by isolating the specific joint of interest. In November 1991, a LIDO Multi-Joint II Dynamometer was purchased to upgrade the strength measurement data collection capability of the Anthropometry and Biomechanics Laboratory. The LIDO Multi-Joint II Dynamometer design offers several advantages over the Cybex II Dynamometer including a more sophisticated method of joint isolation and a more accurate and efficient computer based data collection system. Author

# TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**ACCESSION NUMBER** → A93-11150  
**TITLE** → **STUDIES TOWARDS THE CRYSTALLIZATION OF THE ROD VISUAL PIGMENT RHODOPSIN**  
**AUTHORS** → W. J. DE GRIP, J. VAN OOSTRUM, and G. L. J. DE CALUWE ← **JOURNAL TITLE**  
**AUTHORS' AFFILIATION** → (Nijmegen Catholic Univ., Netherlands) Journal of Crystal Growth (ISSN 0022-0248) vol. 122, no. 1-4 Aug. 1992 p. 375-384. ← **PUBLICATION DATE**  
 Research supported by SRON refs (Contract NWO-SON-328-050)  
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Results are presented of crystallization experiments on bovine *rhodopsin*, which established a restricted range of conditions which reproducibly yield rhodopsin crystals. Several parameters were optimized, including the detergent, the precipitant, additives, and pH. The crystals obtained so far are too small (less than 50 microns in any direction) or of insufficient order to allow high-resolution diffraction analysis. Several approaches are proposed for improving the average size, stability, and order of the rhodopsin crystals.

I.S.

# AEROSPACE MEDICINE AND BIOLOGY

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## LIFE SCIENCES (GENERAL)

(ISSN 0022-0248) vol. 122, no. 1-4 Aug. 1992 p. 375-384.  
Research supported by SRON refs  
(Contract NWO-SON-328-050)  
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Results are presented of crystallization experiments on bovine rhodopsin, which established a restricted range of conditions which reproducibly yield rhodopsin crystals. Several parameters were optimized, including the detergent, the precipitant, additives, and pH. The crystals obtained so far are too small (less than 50 microns in any direction) or of insufficient order to allow high-resolution diffraction analysis. Several approaches are proposed for improving the average size, stability, and order of the rhodopsin crystals.

I.S.

ABSTRACTS

A93-10125

**THE ADRENALIN/NORADRENALIN AND THE ALPHA/BETA ADRENORECEPTOR CORRELATIONS IN THE MYOCARDIUM AND THE ADRENERGIC CHRONOTROPIC AND IONOTROPIC REACTIONS UNDER EXTREME CONDITIONS AND DURING ADAPTATION [SOOTNOSHENIIA ADRELIN:NORADRENALIN I AL'FA-BETA-ADRENORETSEPTORY V MIOKARDE I ADRENERGICHESKIE KHONO- I INOTROPNYE REAKTSII PRI EKSTREMAL'NYKH SOSTOIANIIAKH I ADAPTATSII]**

A. S. CHINKIN (Gosudarstvennyi Pedagogicheskii Inst., Kazan, Russia) *Uspekhi Fiziologicheskikh Nauk* (ISSN 0301-1798) vol. 23, no. 3 July-Sept. 1992 p. 97-106. In Russian. refs  
Copyright

Data are presented demonstrating that the adrenalin/noradrenalin ratio in the myocardium is correlated with the manifestation of ionotropic and chronotropic positive effects mediated, respectively, by the alpha-1 and beta-2 adrenoreceptors in the heart. Therefore, with an increase of adrenalin concentration in the myocardium and with the positive chronotropic effect mediated by beta-1 receptors, the ionotropic reaction of the heart to the alpha-1 adrenoagonists should decrease significantly. This, in fact, takes place during hypoxia and, most probably, under other extreme conditions. I.S.

A93-10636\* National Aeronautics and Space Administration, Washington, DC.

**THE SPACE LIFE SCIENCES STRATEGY FOR THE 21ST CENTURY**

ARNAULD E. NICOGOSSIAN (NASA, Life Sciences Div., Washington) and KAREN K. GAISER (Lockheed Engineering & Sciences Co., Life Sciences Programs Office, Washington) *Acta Astronautica* (ISSN 0094-5765) vol. 26, no. 6 June 1992 p. 459-465. refs

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In the 21st century, NASA's long-term strategy for the exploration of the solar system will combine the assurance of human health and performance for long periods in space with investigations aimed at searching for traces of life on other planets and acquiring fundamental scientific knowledge of life processes. Implementation of this strategy will involve a variety of disciplines including radiation health, life support, human factors, space physiology and countermeasures, medical care, environmental health, and exobiology. It will use both ground-based and flight research opportunities such as those found in current ongoing programs, on Spacelab and unmanned biosatellite flights, and during Space Station Freedom missions. Author

A93-11150

**STUDIES TOWARDS THE CRYSTALLIZATION OF THE ROD VISUAL PIGMENT RHODOPSIN**

W. J. DE GRIP, J. VAN OOSTRUM, and G. L. J. DE CALUWE (Nijmegen Catholic Univ., Netherlands) *Journal of Crystal Growth*

A93-11198

**TO THE STARS WITH THE CYTOSKELETON?**

P. A. HANSSON (St. Bartholomews Hospital, London, United Kingdom) *British Interplanetary Society, Journal* (ISSN 0007-094X) vol. 45, no. 10 Oct. 1992 p. 415-420. refs  
Copyright

A strategy for space exploration is developed based on the concepts of nanotechnology and nanobiology leading to a theoretical intelligent spacecraft comprised uniquely of organic matter. The 'living' spacecraft is described in terms of hypothetical constituents called nanocultures, and cytoskeleton dynamics are explored. Strategies for developing the living spacecraft are listed with attention given to possible targets and propulsion issues, and ecological and evolutionary tenets are mentioned that could be useful for bringing the project to fruition. The paper makes the case that interstellar probes could conceivably be designed via cellular automata constituting general dynamical systems. Some directions are proposed for studying finite-state machines or Turing automata that could be used to build a global computer universal reference frame that is intelligent, self-replicating, and capable of space exploration. C.C.S.

A93-11199

**FLAVOPROTEINS AS NATURAL PROTOTYPES OF MOLECULAR ELECTRONIC DEVICES WITH PHOTOCONTROLLED CONDUCTIVITY**

MIKHAIL S. KRITSKII and NIKOLAI P. L'VOV (Russian Academy of Sciences, Inst. of Biochemistry, Moscow, Russia) *British Interplanetary Society, Journal* (ISSN 0007-094X) vol. 45, no. 10 Oct. 1992 p. 421-426. refs  
Copyright

Photoelectrochemical properties of flavins and flavoproteins are discussed in connection with the role played by light in the control of flavin-mediated electron exchange under prebiotic conditions and in modern organisms. Light-driven nanoelectronic systems of different complexity may be designed by using flavins, their lipophilic derivatives and some flavoproteins. Eukaryotic nitrate reductase and similar flavocytochrome enzymes can be regarded as a promising model for experimental development of such systems. Author

A93-11691

**RESULTS OF EXPERIMENTS ON THE EXPLORATION OF GENETIC EFFECT OF ROCKET FLIGHT FACTORS WITH DROSOPHILA MELANOGASTER**

XIAN-ZHE LIN and GONG-ZHI WANG (Inst. of Space

## 51 LIFE SCIENCES (GENERAL)

Medico-Engineering, Beijing, China) Chinese Journal of Space Science (ISSN 0254-6124) vol. 11, no. 3 July 1991 p. 235-240. In Chinese. refs

Observations on two tests in exploring genetic effect of the factors of T(7A-S1) rocket flight with *Drosophila melanogaster* show that the percentage of the eggs without X-chromosome is increased and the percentage of the eggs with double X-chromosomes is not changed in the total number of eggs laid by female parents in the days after flight (mainly the fourth to sixth). The implication is not that one or two individuals laid a larger number of eggs without X-chromosome, but that there is an increase in the number of female parents laying those eggs. The result of test on the second flight shows that the percentage of chromosome bridges in the neuroblasts of the third instar larvae of the first filial generation produced by female parents in the fourth-to-sixth day after flight is increased. Author

**A93-12860**

### **THE RESPONSE OF MEDULLAR RESPIRATORY NEURONS TO THE STIMULATION OF THE AMYGDALOID NUCLEI UNDER HYPOXIA [REAKTSIIA DYKHATEL'NYKH NEIRONOV PRODOLGOVATOGO MOZGA NA RAZDRAZHENIE IADER MINDALEVIDNOGO KOMPLEKSA PRI GIPOKSII]**

N. S. AKOPIAN, O. G. BAKLAVADZHIAN, and N. V. SARKISIAN (Erevanskii Gosudarstvennyi Univ., Yerevan, Armenia) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X) vol. 77, no. 12 Dec. 1991 p. 41-49. In Russian. refs

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The effect of the stimulation of amygdaloid nuclei on the impulse activity of the inspiratory, expiratory, and reticular neurons in the respiratory center of medulla oblongata was investigated in rats fitted with implanted microelectrodes in the medulla and amygdala. It was found that the stimulation effect had a complex dependence on the interaction between the stage of hypoxia and the neuronal background activity. I.S.

**A93-12861**

### **THE EFFECT OF LOW-INTENSITY ELECTROMAGNETIC MILLIMETER-WAVE RADIATION ON THE RAT CARDIOVASCULAR SYSTEM [VLIANIE ELEKTROMAGNITNOGO IZLUCHENIIA MILLIMETROVOGO DIAPAZONA MALOI MOSHCHNOSTI NA SERDECHNO-SOSUDISTUIU SISTEMU BELOI KRYSY]**

I. L. POMEKHINA, G. N. AKOEV, L. D. ENIN, and V. D. OLEINER (Russian Academy of Sciences, Inst. of Physiology; Centre of Standardisation and Metrology, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 1 Jan. 1992 p. 35-41. In Russian. refs

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The effect of low-intensity electromagnetic millimeter-wave radiation on the cardiovascular system was investigated in rats exposed to 53-78 GHz, 10-mW/sq cm microwave radiation. It was found that millimeter-wave radiation did not affect the body and skin temperatures, but induced arrhythmia, which was most noticeable at the frequency range 55-73 GHz. I.S.

**A93-12863**

### **THE EFFECT OF CORTICAL VESTIBULAR AREA STIMULATION ON THE ACTIVITY OF THE NEURONS OF LATERAL VESTIBULAR NUCLEI DURING VIBRATION [VLIANIE RAZDRAZHENIIA VESTIBULIARNOI OBLASTI KORY NA AKTIVNOST' NEIRONOV LATERAL'NOGO VESTIBULIARNOGO IADRA PRI VIBRATSII]**

S. M. MINASIAN, TS. I. ADAMIAN, S. G. SAAKIAN, and S. R. AGADZHANIAN (Yerevan State Univ., Armenia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 2 Feb. 1992 p. 32-39. In Russian. refs

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The effect of the stimulation of the cortical vestibular area on the neuronal activity in the lateral vestibular nucleus under conditions of vibration was investigated in rabbits fitted with microelectrodes in both areas. Results indicated a shift in the frequency distribution of the vestibular nucleus neurons toward

higher-rhythm values. It was found that prolonged vibration weakens the inhibitory effect of the corticofugal reaction and increases its activating effect on the neuronal activity of the lateral vestibular nucleus. The effect was most pronounced in neurons with a low-frequency background activity. I.S.

**A93-12864**

### **THE EFFECT OF THE ACTIVATION OF THE SYMPATHO-ADRENAL SYSTEM ON CATECHOLAMINE INACTIVATION IN RAT LUNGS [VLIANIE AKTIVIZATSII SIMPATOADRENALOVOI SISTEMY NA LEGOCHNUIU INAKTIVATSIIU KATEKHOLAMINOV U KRYSY]**

A. A. BONETSKII and V. I. FEDOROV (Kirgizskii NII Ekologii i Profilaktiki Infektsionnykh Boleznai, Bishkek, Kyrgyzstan) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 2 Feb. 1992 p. 81-86. In Russian. refs

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The effects of similar levels of hyperadrenalinemia induced by enforced immobilization or by adrenaline injections on the inactivation of noradrenaline in rat lungs were investigated in rats with catheterized lung aortas or cannulated hip veins. It was found that immobilization led to a decrease of noradrenaline inactivation, while the adrenaline injection was followed by an increase of inactivation, indicating that changes in the noradrenaline inactivation in lungs of immobilized rats were not caused by an adrenaline increase. I.S.

**A93-13528**

### **PROTECTION OF ACANTHOPANAX SENTICOSUS AGAINST SUSPENSION-INDUCED BONE LOSS IN RATS**

ZHIZHEN SHI (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 1-4. In Chinese. refs

Improvement of *Acanthopanax senticosus* in the weight-bearing bones of suspended rats was investigated. It was found from the results that *Acanthopanax senticosus* was capable of significantly increasing a growth rate of tibia, strength and deflection of femurs, percent content of protein, calcium and phosphorus, decrease in fat content, and great improvement in calcification of femurs during recovery period. These results indicate that *Acanthopanax senticosus* can improve the bone metabolism of rats so as to have protection of the weight bearing bones of the animals against the effects of the simulated weightlessness. Author

**A93-13530**

### **EFFECT OF DL-DOPA, L-5-HTP AND PENTOBARBITAL SODIUM ON BRAIN ENCEPHALOFLECTUROGRAPHS IN RATS**

YANQIANG BAI (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 17-21. In Chinese. refs

Brain waves were recorded in forty rats which were divided into four groups of control, DL-DOPA, L-5-HTP and pentobarbital sodium. Important results were obtained using encephaloflecturographs (ET) analysis. The cerebral active states of control group were not constant and their eigenfrequencies were relatively variant, which however, turned to obvious regularity after drug administration. S11 (22) was verified to be related to the DA activity and S4 series related to the 5-HT activity. The 5-HT system had relatively complicated effects on brain function and interaction with the DA system. Pentobarbital sodium had powerful inhibitory effect on central nervous system and S13 was its eigenfrequency. It was considered that S13 was related to the hyperactivity of GABA. All these obtained results have showed that ET technique has good future prospects in brain research. Author

**A93-13532**

### **PRELIMINARY STUDY ON THE PHYSIOLOGICAL CHANGES AND TOLERANCE IN GROUND SQUIRRELS UNDER SEVERAL SPECIFIC EXPERIMENTAL CONDITIONS**

JINGXUE ZHANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 27-31. In Chinese. refs

Experimental studies were carried out on adult ground squirrels (*Citellus dauricus*) weighing 250.0  $\pm$  15.0 gm. Physiological responses and tolerance of the animals were observed preliminarily. Under the combined conditions the animals could maximally tolerate to high temperature of 35 C for 24 h. Under a low temperature of 23 C body temperature of the animals was 31.6  $\pm$  0.84 C, which showed that they probably entered initial stage of hibernation. Under normal or low temperatures and fed no food and water, the animals could survive for 14-31 days. They could also be tolerant of acceleration and mechanical impact force. When an impact of 1300 g for 1.35 sec was made on them and left them fall down upon the hard ground, still they might survive.

Author

**A93-13536****RESPONSE CHARACTERISTICS OF SEMICIRCULAR CANAL IN CATS UNDER LINEAR ACCELERATION**

JINGSHEN PEI (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 79-84. In Chinese. refs

Response characteristics of vestibuloocular reflex, vestibulospinal reflex, and somatosensory evoked potential (SEP) in cats with surgically destructed otolith organs were studied under linear acceleration. After destruction of the bilateral otolith organs, significant changes in dynamic characteristics of otolith-ocular reflex and in latent time and amplitude of early component of SEP were observed. Response patterns of H wave of spinal reflex were altered under different linear accelerations. After destruction of the unilateral otolith organs, decay of prerotation nystagmus showed significant asymmetry which meant asymmetry of canal functions. The results suggested that there is intermodulation between the functions of otolith and semicircular canal, and that the potential asymmetrical functions of otolith and semicircular canal be a possible factor causing vestibular dysfunction in space.

Author

**A93-13538****PRELIMINARY OBSERVATION OF INFLUENCES OF THREE FORMS OF SIMULATED WEIGHTLESSNESS ON HEMORHEOLOGICAL CHARACTERISTICS IN RABBIT**

CHENG JIANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 91-95. In Chinese. refs

Changes in hemorheological parameters in three groups of rabbits were observed under three types of simulated weightlessness. Electromyograms (EMGs) of the rabbits' hindlimbs were recorded and a spectral analysis of the EMG was conducted. It was found that different types of simulated weightlessness had different influences on the hemorheological characteristics in the rabbits. Under simulated weightlessness there were various factors which could influence hemorheological characteristics. Different muscle loads and stress levels of the whole body can contribute to these effects.

Author

**A93-13540****STUDY ON MECHANICAL CHARACTERISTICS OF VISCERA IN DOGS**

YULAN WANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 103-107. In Chinese. refs

Natural frequency, damping ratio, transfer ratio, and linearity of the main viscera (lung, heart, liver and stomach) in dogs were measured under sine wave vibration of 2-30 Hz on the whole body and isolated organs. The results showed that the mechanical characteristics of various viscera under whole body vibration were markedly different from those under isolated organ vibration. There were less differences among the various postures.

Author

**A93-13542****EXPERIMENTAL RESEARCH ON THE ANTI-IRRADIATION EFFECTS OF KW-1 - PROTECTIVE EFFECT ON THE 5-HT CONTENT OF TISSUES IN IRRADIATED MICE**

YONGFA ZHANG (Inst. of Space Medico-Engineering, Beijing,

China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 113-117. In Chinese. refs

The kinetic changes of 5-HT content in the tissues and WBC count of the Co-60-irradiated mice were observed. The results indicate that 5-HT contents decreased significantly in some of the tissues (blood, spleen, and cerebrum) but increased in the intestine after the irradiation, and that the WBC count decreased in a great quantity after the irradiation. The recovery of the WBC count was accelerated by KW-1 which could stimulate proliferation of the hematopoietic stem cells. Administration of KW-1 increased the 5-HT contents significantly in the blood, intestine, spleen, and cerebrum after the irradiation, thus improving innate natural resistance against irradiation damage.

Author

**A93-13543****OBSERVATION OF CHANGE IN CYTOCHROME OXIDASE CONTENT OF CEREBRAL CORTEX IN RAT UNDER +GZ STRESS**

BAOSHENG XIE (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 123-126. In Chinese. refs

Cytochrome oxidases in the cerebral cortex of the rats exposed to +5Gz and +8Gz for 3 min were determined using histochemical techniques. It was found that the content of cytochrome oxidase the cerebral cortex increased with increase of G value. The results indicated that a change in brain-energy metabolism occurred during +Gz stress.

Author

**A93-13544****APPLICATION OF SYSTEM IDENTIFICATION TO RESEARCH ON CARDIOVASCULAR REGULATIVE FUNCTION**

HONGYUAN SUN (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 127-129. In Chinese. refs

The regulative function of the cardiovascular system of rabbits under LBNP were studied using the theory and method of system identification and information entropy. The 16 rabbits were divided into a control group (3 rabbits), reserpine group (6 rabbits) and atropine group (7 rabbits). The results showed that there was no significant change in the control group, and that the steady-state gain and information entropy, time of tolerance to LBNP, and blood pressure control quality increased, shortened and deteriorated in the reserpine group, but decreased, lengthened and enhanced in the atropine group.

Author

**A93-13545****EFFECTS OF OXYGEN ON REGULATION OF CEREBRAL BLOOD FLOW IN RABBITS ADAPTED TO HYPOXIA**

ZHAORONG LIU (Inst. of Hygiene and Environmental Medicine, Tianjing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 130-135. In Chinese. refs

Rabbits were used to investigate the effects of oxygen on regulation of cerebral blood flow (CBF) in the rabbits adapted to hypoxia using electromagnetic flowmeter under acute exposure to various oxygen levels of air. The results showed: (1) responses of cerebral vessels and CBF to hypoxia did not alter significantly in the adapted group but were significantly exaggerated in the control group; (2) during perfusing the space under the cranial window with artificial cerebrospinal fluid equilibrated with 100 percent N<sub>2</sub>, diameter of microvessels on cerebral surface did not change significantly in the adapted group but significantly increased in the control group; (3) PaO<sub>2</sub>, PvO<sub>2</sub> in brain, arterial oxygen saturation, cerebrospinal fluid pressure were higher in the adapted group than in the control group; and (4) arterio-venous difference of oxygen in brain, BP, PaCO<sub>2</sub>, and PvCO<sub>2</sub> in brain were similar in the two groups.

Author

## 51 LIFE SCIENCES (GENERAL)

**A93-13709**

**EFFECTS OF POSITIVE ACCELERATION ON THE MICROCIRCULATION OF RABBIT CONJUNCTIVA, MESENTERY, SKIN, AND PIA MATER**

ZUNYAO LIU (Guangzhou Air Force Hospital, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 184-186. In Chinese. refs

It is reported that the microcirculatory changes of several parts of rabbit, including skin and viscera, were synchronously observed before and after centrifugation. It was showed that the biomechanic effects of +Gz on microcirculation were not similar in different organs, time course, and sites, but the basic dynamic alterations were the same. The microcirculation of pia mater remained constant. The present experiments demonstrated the possibility of studying the biologic effect of aerospace environmental elements at the microdynamic level in simulation experiments, especially the physiologic and pathologic effects of HSC of the new generation of fighters. Author

**A93-13712**

**THE EFFECTS OF EXPOSURE TO 50 MT ELF MAGNETIC FIELDS FOR 96 H ON RABBIT EEG**

ZHENJIE LI (Naval Medical Research Inst., Shanghai, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 199-202. In Chinese. refs

The effects of exposure to 50 mT ELF magnetic fields for 96 h on rabbit EEG were reported. The results showed that, under the experimental conditions, the low-frequency components of EEG increased, the harmonization of two lead EEG in low frequency range was strengthened, and the transmission function of the rabbit brain tended to be inhibited. These results suggest that much more attention should be paid to the ELF magnetic field contamination. Author

**A93-13717**

**THE EFFECTS OF CEPHALAD BODY FLUID REDISTRIBUTION ON THE ULTRASTRUCTURE OF THE VESTIBULAR APPARATUS OF GUINEA PIG**

TIANXIANG WONG (Beijing Medical Univ., China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 245-249. In Chinese. refs

Guinea pigs were exposed to head-down (-30 deg) suspension to cause cephalad redistribution of body fluid to study the effects of simulated weightlessness on the ultrastructure of the vestibular apparatus. On the fourth day of the suspension, no evident changes were found in the vestibular apparatus in the two control groups (normal and lying in horizontal position). But the type I hair cell of vestibular sensory epithelium of the animals in the suspended group changed significantly, including swelling of mitochondria and rupture of mitochondria membrane and crista, areas of vacuolization in the cytoplasm, disorientation and partial missing of cilia, and bulging and creasing of cuticular plate. The results show that changes in vestibular apparatus appear following cephalad redistribution of body fluid, which might be one of the etiopathological factors evoking motion sickness. Author

**A93-13720**

**IDENTIFICATION OF DEGREE OF HEAD INJURY CAUSED BY IMPACT LOADS IN DOG AND RABBIT**

GUIRONG WU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 261-266. In Chinese. refs

Impacts on occiputs of dogs and rabbits were given by simple impact equipment to observe changes of CPK in cerebrospinal fluid and intracranial pressure with different degrees of head injury. The results indicate that CPK and intracranial pressure increase exponentially with the degree of head injury. It seems that they might serve as indices in judging the degree of animal head injury. Special behavioral and psychological responses were also observed in the animals developing brain concussion. They could serve as signs for preliminary diagnosis. Author

**A93-13722**

**INVESTIGATION OF NONLINEAR DYNAMIC RESPONSES TO RANDOM VIBRATION IN DOGS**

FANGZI WANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 277-281. In Chinese.

In order to investigate the dynamic responses of animal body, transducers were implanted in various body parts of 6 dogs. Transmissibilities of L5, L6, L7, liver, stomach, chest, and abdominal walls were observed in vertical position under 1-, 2-, and 3-G random vibrations of 1-250 Hz in cephalo-coccyx direction. The moduli of transfer function showed that resonance frequencies were substantially the same in various parts of dog's body, while phase shift existed in other parts. The frequency of fundamental resonance decreased with increasing G levels of vibration. The responses of partial viscera can be estimated from the responses of chest and abdominal walls. Author

**N93-10085\*#** Purdue Univ., West Lafayette, IN. Chemical Engineering.

**DEVELOPMENT OF PHYSICAL AND MATHEMATICAL MODELS FOR THE POROUS CERAMIC TUBE PLANT NUTRIFICATION SYSTEM (PCTPNS)**

D. TEH-WEI TSAO, M. R. OKOS, J. C. SAGER (National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.), and T. W. DRESCHER (Bionetics Corp., Cocoa Beach, FL.) Jul. 1992 115 p (Contract NAS10-11624) (NASA-TM-107551; NAS 1.15:107551) Avail: CASI HC A06/MF A02

A physical model of the Porous Ceramic Tube Plant Nutrifcation System (PCTPNS) was developed through microscopic observations of the tube surface under various operational conditions. In addition, a mathematical model of this system was developed which incorporated the effects of the applied suction pressure, surface tension, and gravitational forces as well as the porosity and physical dimensions of the tubes. The flow of liquid through the PCTPNS was thus characterized for non-biological situations. One of the key factors in the verification of these models is the accurate and rapid measurement of the 'wetness' or holding capacity of the ceramic tubes. This study evaluated a thermistor based moisture sensor device and recommendations for future research on alternative sensing devices are proposed. In addition, extensions of the physical and mathematical models to include the effects of plant physiology and growth are also discussed for future research. Author

**N93-10109\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**METHOD FOR CULTURING MAMMALIAN CELLS IN A PERFUSED BIOREACTOR Patent**

RAY P. SCHWARZ, inventor (to NASA) and DAVID A. WOLF, inventor (to NASA) 13 Oct. 1992 10 p Filed 28 Jun. 1990 Division of US-Patent-Appl-SN-213559, filed 30 Jun. 1988 (NASA-CASE-MSC-21293-2; US-PATENT-5,155,035; US-PATENT-APPL-SN-545233; US-PATENT-APPL-SN-213559; US-PATENT-CLASS-435-240.24; US-PATENT-CLASS-435-240.25; US-PATENT-CLASS-435-240.46; INT-PATENT-CLASS-C12N-5/02) Avail: US Patent and Trademark Office

A bio-reactor system wherein a tubular housing contains an internal circularly disposed set of blade members and a central tubular filter all mounted for rotation about a common horizontal axis and each having independent rotational support and rotational drive mechanisms. The housing, blade members and filter preferably are driven at a constant slow speed for placing a fluid culture medium with discrete microbeads and cell cultures in a discrete spatial suspension in the housing. Replacement fluid medium is symmetrically input and fluid medium is symmetrically output from the housing where the input and the output are part of a loop providing a constant or intermittent flow of fluid medium in a closed loop.

Official Gazette of the U.S. Patent and Trademark Office

**N93-10110\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**METHOD FOR CULTURING MAMMALIAN CELLS IN A HORIZONTALLY ROTATED BIOREACTOR Patent**

RAY P. SCHWARZ, inventor (to NASA), DAVID A. WOLF, inventor (to NASA), and TINH T. TRINH, inventor (to NASA) 6 Oct. 1992 7 p Filed 15 Apr. 1991 Division of US-Patent-Appl-SN-213558, filed 30 Jun. 1988

(NASA-CASE-MS-C-21294-2; US-PATENT-5,153,133; US-PATENT-APPL-SN-687605; US-PATENT-APPL-SN-213558; US-PATENT-CLASS-435-240.24; US-PATENT-CLASS-435-240.25; US-PATENT-CLASS-435-240.46; US-PATENT-CLASS-435-240.241; US-PATENT-CLASS-435-818; INT-PATENT-CLASS-C12N-5/02) Avail: US Patent and Trademark Office

A bio-reactor system where cell growth microcarrier beads are suspended in a zero head space fluid medium by rotation about a horizontal axis and where the fluid is continuously oxygenated from a tubular membrane which rotates on a shaft together with rotation of the culture vessel. The oxygen is continuously throughput through the membrane and disbursed into the fluid medium along the length of the membrane.

Official Gazette of the U.S. Patent and Trademark Office

**N93-10461#** Brookhaven National Lab., Upton, NY.

**RESOURCE CAPTURE BY SINGLE LEAVES**

S. P. LONG May 1992 36 p Presented at the 52nd International Easter School, Resource Capture By Crops, Nottingham, 30 Mar. - 2 Apr. 1992

(Contract DE-AC02-76CH-00016) (DE92-015847; BNL-47574; CONF-9203160-1) Avail: CASI HC A03/MF A01

Leaves show a variety of strategies for maximizing CO<sub>2</sub> and light capture. These are more meaningfully explained if they are considered in the context of maximizing capture relative to the utilization of water, nutrients, and carbohydrates reserves. There is considerable variation between crops in their efficiency of CO<sub>2</sub> and light capture at the leaf level. Understanding of these mechanisms indicate some ways in which efficiency of resource capture could be level cannot be meaningfully considered without simultaneous understanding of implications at the canopy level.

DOE

**N93-10628#** Los Alamos National Lab., NM.

**SELF-PROGRAMMING OF MATTER AND THE EVOLUTION OF PROTO-BIOLOGICAL ORGANIZATIONS**

STEEN RASMUSSEN (Santa Fe Inst., NM.), RASMA FELDBERG (Technical Univ. of Denmark, Lyngby.), and CARSTEN KNUDSEN (Technical Univ. of Denmark, Lyngby.) 1992 11 p Presented at the Frontiers of Life, Blois (France), Oct. 1991

(Contract W-7405-ENG-36) (DE92-015244; LA-UR-92-1722; CONF-9110388-1) Avail: CASI HC A03/MF A01

We propose a novel class of formal dynamical systems, which are referred to as self-programming or constructive. We believe that these systems form natural models for functional self-organization in prebiotic and proto-biological systems. We shall use the computer as a 'test-tube' to follow the dynamics of these systems and in particular investigate their emergent functional properties. Using the computer as a simulation laboratory to understand such processes in this context based on two fundamental assumptions: (1) That the logic, e.g., the dynamics and the functional organization, of a physical and in particular a living system can be described in terms of mathematics and hence can be studied independent of the molecular hardware that carries this dynamics. (2) That the properties of structures and organizations emerging from the dynamics of self-programming systems reflect aspects of the organizing principles of prebiotic and proto-biological systems. We shall show that for instance the emergence of complex cooperative structures is part of the natural dynamics of self-programming systems.

DOE

**N93-10834#** Pacific Northwest Lab., Richland, WA.

**RADIATION DAMAGE TO DNA**

J. H. MILLER Apr. 1992 9 p Presented at the 14th Werner Brandt Workshop on Charged Particle Penetration Phenomena, Oak Ridge, TN, 30 Apr. - 1 May 1992

(Contract DE-AC06-76RL-01830) (DE92-015760; PNL-SA-21039; CONF-9204144-2) Avail: CASI HC A02/MF A01

Our goal is to calculate the probability of ejecting electrons from DNA by charged particles that pass near the macromolecule as they slow down in an aqueous medium that contains DNA in low concentration. This process is illustrated for a particle of charge Ze and velocity v, where impact parameters b(sub 1), b(sub 2), and b(sub 3) indicate the distances between the trajectory and a phosphate group, a base, and a sugar moiety, respectively. In the present state of our theoretical development, we must treat each of these components of DNA as an independent impurity site occupied by electrons in a Slater-type orbital with a characteristic orbital radius and band gap. Determination of these parameters will be discussed below; however, before we turn to that part of the discussion, it is interesting to address the question of multiple ionizations of DNA by the passage of a single charged particle.

DOE

**N93-10835#** Michigan State Univ., East Lansing. Plant Research Lab.

**INTERDISCIPLINARY RESEARCH AND TRAINING PROGRAM IN THE PLANT SCIENCES**

C. P. WOLK 1992 105 p

(Contract DE-FG02-91ER-20021) (DE92-015919; DOE/ER-20021/2) Avail: CASI HC A06/MF A02

Our research on plants has continued. The following topics are discussed: molecular basis of symbiotic plant-microbe interactions; enzymatic mechanisms and regulation of plant cell wall biosynthesis; molecular mechanisms that regulate the expression of genes in plants; resistance of plants to environmental stress; studies on hormone biosynthesis and action; plant cell wall proteins; interaction of nuclear and organelle genomes; sensor transduction in plants; molecular mechanisms of trafficking in the plant cell; regulation of lipid metabolism; molecular bases of plant disease resistance mechanisms; biochemical and molecular aspects of plant pathogenesis; developmental biology of nitrogen-fixing cyanobacteria; environmental control of plant development and its relation to plant hormones.

DOE

**N93-10974#** Lawrence Livermore National Lab., CA.

**MOLECULAR CYTOGENETICS: A NOVEL APPROACH FOR MEASURING CHROMOSOME TRANSLOCATIONS IN INDIVIDUAL YEARS AFTER EXPOSURE TO LOW LEVELS OF IONIZING RADIATION**

JOE NATHAN LUCAS and TORE STRAUME Apr. 1992 5 p Presented at the 2nd International Conference on Effects of Low-Dose Ionizing Radiation, Bournemouth, United Kingdom, 18-20 May 1992

(Contract W-7405-ENG-48) (DE92-018066; UCRL-JC-109874; CONF-9205118-1) Avail: CASI HC A01/MF A01

Chromosome painting was developed in our laboratory to facilitate rapid and accurate detection of chromosome translocations in human cells. Chromosome painting is the selective staining of one or more chromosomes by fluorescence in situ hybridization (FISH) using whole chromosome probes. This method permits essentially uniform hybridization and staining along the entire lengths of targeted chromosomes. Staining all other chromosomes a different color makes interchromosomal exchange aberrations readily apparent as bicolored chromosomes. Here we present a brief discussion of this methodology and recent results from studies in our laboratory.

DOE

**N93-11630#** Brookhaven National Lab., Upton, NY.

**THE POTENTIAL EFFECTS OF CONCURRENT INCREASES IN TEMPERATURE, CO<sub>2</sub> AND O<sub>3</sub> ON NET PHOTOSYNTHESIS, AS MEDIATED BY RUBISCO**

## 51 LIFE SCIENCES (GENERAL)

S. LONG Jul. 1992 26 p Presented at the Air Pollutants and Plant Metabolism Conference, Blacksburg, VA, 13-16 Jun. 1992 (Contract DE-AC02-76CH-00016) (DE92-019411; BNL-47624; CONF-9206254-1) Avail: CASI HC A03/MF A01

At the leaf level, under light saturating and light limiting conditions, it is shown that elevated atmospheric CO<sub>2</sub> concentration not only alters the scale of the response of carbon gain to rising temperature, but can alter the direction of response. These points bring into serious question the value of any predictions of plant production which ignore not only the direct effect of CO<sub>2</sub> on carbon gain, but also the basic interactions of temperature, CO<sub>2</sub>, and O<sub>3</sub>. While many factors may potentially diminish the enhancement of light saturated leaf photosynthetic rates with increase in atmospheric CO<sub>2</sub> concentrations, no mechanism has so far been identified which could remove the parallel stimulation of light-limited photosynthesis. DOE

**N93-12014\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.  
**EFFECT OF HEMORRHAGE ON CARDIAC OUTPUT, VASOPRESSIN, ALDOSTERONE, AND DIURESIS DURING IMMERSION IN MEN**

J. E. GREENLEAF, K. SIMANONOK (California Univ., Davis.), E. M. BERNAUER (California Univ., Davis.), C. E. WADE, and L. C. KEIL Sep. 1992 13 p (Contract RTOP 199-18-12-07) (NASA-TM-103949; A-92141; NAS 1.15:103949) Avail: CASI HC A03/MF A01

The purpose of this research was to test the hypothesis that a reduction in blood volume would attenuate or eliminate immersion-induced increases in cardiac output ( $Q_{sub\ co}$ ) and urine excretion, and to investigate accompanying vasoactive and fluid-electrolyte hormonal responses. Eight men (19-23 yr) were supine during a 2-hr control period in air, and then sat for 5-hr test periods in air at 20 C (dry control, DC); water at 34.5 C (wet control, WC); and water (34.5 C) after hemorrhage (WH) of 14.8 plus or minus 0.3 percent of their blood volume. Blood volume was -11.6 plus or minus 0.6 percent at immersion (time 0). Mean ( $\bar{X}$  hrs 1-5)  $Q_{sub\ co}$  was unchanged in WC (5.3 plus or minus 0.01 l/min) and in WH (4.5 plus or minus 0.1 l/min), but decreased (P less than 0.05) in DC to 3.6 plus or minus 0.1 l/min. Mean urine excretion rates were 1.0 plus or minus 0.2 ml/min for DC and 1.1 plus or minus 0.2 ml/min for WH; both were lower (P less than 0.05) than that for WC of 2.0 plus or minus 0.4 ml/min. Plasma (Na<sup>+</sup>) and (Osm) were unchanged in all experiments. Mean plasma vasopressin (PVP) ( $\bar{X}$  hrs 1-5) was 1.1 plus or minus 0.1 pg/ml in WC, and higher (P less than 0.05) in DC (2.1 plus or minus 0.2 pg/ml) and WH (2.1 plus or minus 0.1 pg/ml); it was unchanged during air and water test periods. Thus, hemorrhage attenuated the immersion-induced increase in  $Q_{sub\ co}$ , eliminated the WC diuresis, maintained plasma renin activity and PVP at DC levels and did not change immersion-induced aldosterone suppression; the osmotic diuresis during control immersion is apparently not due to either aldosterone suppression or vasopressin suppression. Author

**N93-12174\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**MICROBIOLOGICAL ANALYSIS OF DEBRIS FROM STS-42 IML-1 BY DIRECT PLATING OF RINSE WATERS**

G. A. SMITHERS Oct. 1992 20 p (NASA-TM-108375; NAS 1.15:108375) Avail: CASI HC A03/MF A01

Microbial analysis of air filter debris from the Spacelab International Microgravity Laboratory-1 (IML-1) mission was performed via direct plating of rinse waters on a battery of selective and nonselective nutrient agars. Microbial isolates were identified using Minitek and Biolog technologies. Twenty-four types of bacteria were recovered and classified; a similar number of fungal types was observed, but these were not identified. This procedure can provide information about the proportions of organism types present at the time of debris collection. Author

**N93-12266#** Columbia Univ., New York, NY. Center for Radiological Research.

**RADIATION PHYSICS, BIOPHYSICS, AND RADIATION BIOLOGY**

E. J. HALL May 1992 60 p (Contract DE-FG02-88ER-60631) (DE92-013673; DOE/ER-60631/10) Avail: CASI HC A04/MF A01

The following research programs from the Center for Radiological Research of Columbia University are described: design and development of a new wall-less ultra miniature proportional counter for nanodosimetry; some recent measurements of ionization distributions for heavy ions at nanometer site sizes with a wall-less proportional counter; a calculation of exciton energies in periodic systems with helical symmetry -- application to a hydrogen fluoride chain; electron energy-loss function in polynucleotide and the question of plasmon excitation; a non-parametric, microdosimetric-based approach to the evaluation of the biological effects of low doses of ionizing radiation; high-LET radiation risk assessment at medium doses; high-LET radiobiological effects -- increased lesion severity or increased lesion proximity; photoneutrons generated by high energy medical linacs; the biological effectiveness of neutrons; implications for radiation protection; molecular characterization of oncogenes induced by neutrons; and the inverse dose-rate effect for oncogenic transformation by charged particles is LET dependent. DOE

**N93-12315#** Oak Ridge National Lab., TN.

**SCALING ISSUES FOR BIODIVERSITY PROTECTION**

S. M. PEARSON, M. G. TURNER, R. H. GARDNER, and R. V. ONEILL 1992 33 p Presented at the United States Department of Agriculture (USDA) Forest Service Symposium on Biodiversity in Managed Landscapes: Theory and Practice, Sacramento, CA, 12-15 Jul. 1992

(Contract DE-AC05-84OR-21400) (DE92-016689; CONF-9207106-1) Avail: CASI HC A03/MF A01

Environmental heterogeneity, in both space and time, has been important in the evolution and maintenance of biodiversity. Moreover, this heterogeneity is hierarchical in nature. Differences occur between biomes, between landscapes. Thus, hierarchical patterns of heterogeneity are a consequence of the complexity within ecological communities, and the maintenance of biodiversity means the preservation of this complexity. Natural landscapes are dynamic systems that exhibit temporal and spatial heterogeneity. However, the exploitative nature of human activity tends to simplify landscapes (Krummel et al. 1987). The challenge of preserving biodiversity in managed landscapes is to incorporate natural levels of spatial and temporal heterogeneity into management schemes. The concept of scale has emerged as an important topic among ecologists that recognize the role of heterogeneity in natural ecosystems. Subjects related to scale such as grain (level of detail) and extent (size of area or duration of time) are frequently used to determine the appropriate interpretation of ecological data. Likewise, scale is important when applying ecological principles to biodiversity protection and conservation. The scale of a conservation endeavor affects the strategy involved, realistic goals, and probability of success. For instance, the spatial extent of a reserve system may be determined, for better or worse, by biogeography, distribution of surviving populations, political boundaries, or fiscal constraints. Our objectives are to: emphasize the importance of natural patterns of spatial and temporal heterogeneity, encourage a broader-scale perspective for conservation efforts, and illustrate the interaction between landscape-level heterogeneity and organism-based scales of resource utilization with a simulation experiment. DOE

**N93-12482#** Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.

**BIOLOGICAL CONVERSION OF SYNTHESIS GAS CULTURE DEVELOPMENT**

K. T. KLASSON, R. BASU, E. R. JOHNSON, E. C. CLAUSEN, and J. L. GADDY Mar. 1992 55 p

(Contract DE-FG21-90MC-27225)  
(DE92-001279; DOE/MC-27225/3091) Avail: CASI HC A04/MF  
A01

Research continues on the conversion of synthesis by shift reactions involving bacteria. Topics discussed here include: biological water gas shift, sulfur gas utilization, experimental screening procedures, water gas shift studies, H<sub>2</sub>S removal studies, COS degradation by selected CO-utilizing bacteria, and indirect COS utilization by Chlorobia. DOE

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## AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**A93-10124**  
**PRINCIPLES OF THE ORGANIZATION OF CALCIUM METABOLISM [PRINTSIPY ORGANIZATSII OBMENA KAL'TSIIA]**

A. I. GRIGOR'EV and I. M. LARINA (Inst. Mediko-Biologicheskikh Problem, Moscow, Russia) *Uspekhi Fiziologicheskikh Nauk* (ISSN 0301-1798) vol. 23, no. 3 July-Sept. 1992 p. 24-52. In Russian. refs  
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The physicochemical mechanisms responsible for the stability of calcium balance in the extracellular space of the human body is discussed with special attention given to hormonal feedback. Data are presented illustrating the mechanisms of the calcium homeostasis maintenance at various levels of the organization of the human body, with particular attention given to the monitoring of the time and extent of variations in calcium ion concentration. The role of calcium ions in the activity of various effector systems is also discussed. I.S.

**A93-10326**  
**EFFECTS OF 2 MG AND 4 MG ATROPINE SULFATE ON THE PERFORMANCE OF U.S. ARMY HELICOPTER PILOTS**

JOHN A. CALDWELL, JR., ROBERT L. STEPHENS, DAVID J. CARTER, and HEBER D. JONES (U.S. Army, Aeromedical Lab., Fort Rucker, AL) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 857-864. refs

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Atropine autoinjectors are issued to aviators for use in the event of organophosphate poisoning on the battlefield. This investigation assessed the effects of unchallenged 2 mg and 4 mg doses on flight performance, vision, tracking, cognitive performance, and electroencephalograms of 12 Army aviators. Effects were seen most often with the 4 mg dose in terms of aircraft control problems, vision disturbances, impaired tracking, reduced cortical activation, and decreased cognitive skill. These problems indicate helicopter tactical flight is dangerous after an unchallenged 4 mg dose. Other types of flight should also be avoided for at least 12 h after atropine. Author

**A93-10327**  
**SUBJECTIVE AND BEHAVIORAL EFFECTS ASSOCIATED WITH REPEATED EXPOSURE TO NARCOSIS**

K. HAMILTON, M.-F. LALIBERTE, and R. HESLEGRAVE (Defence and Civil Inst. of Environmental Medicine, North York, Canada) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 865-869. refs

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Below 30 m, nitrogen narcosis can severely degrade the performance of air breathing divers. It is generally thought that this effect can be reduced by repeating deep air dives on successive days, but laboratory studies have found no strong evidence to support the notion of adaptation to narcosis. One

possible explanation for this discrepancy is that one's subjective impression or perception of narcosis may decrease during repeated exposure to hyperbaric air without parallel improvement on task performance. To examine this possibility, symptoms and performance were examined over the course of five days of repeated exposure to 30 percent nitrous oxide at 1 ATA. While the results revealed no clear-cut changes in global perceptions of narcosis across days, several symptoms from an adjective checklist showed unequivocal signs of adaptation. With respect to performance effects, reaction time yielded no indications of improvement over days relative to the control. These findings suggest that subjective adaptation can occur without parallel performance improvement, an effect which could compromise safety and which may be of concern in other operational settings that involve repeated exposure to stimulus conditions which impact on performance and symptoms. Author

**A93-10329**  
**REDUCED VOLUNTARY NON-VISUAL SUPPRESSION OF THE VESTIBULO-OCULAR REFLEX GAIN DURING NITROUS OXIDE NARCOSIS**

SERGE PADOAN, MANS MAGNUSSON, MICAEL AKESSON (Lund Univ. Hospital, Sweden), and HANS ORNHAGEN (National Defense Research Establishment, Harsfjarden, Sweden) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 875-880. Research supported by Swedish Medical Research Council, Soderberg Foundation, and Swedish Defence Research Establishment refs

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The effect of subanesthetic N<sub>2</sub>O narcosis (21 percent) on the vestibulo-ocular reflex (VOR) and on voluntary non-visual suppression of the VOR was studied in 12 subjects, using a velocity step rotational test. Gain and time constant of the VOR were calculated by computer. During test, the subjects were required either to perform mental arithmetic or to attempt to follow an imaginary target rotating with them in the dark. Voluntary non-visual suppression of gain was significantly reduced during exposure to N<sub>2</sub>O, though there was no statistically significant effect of N<sub>2</sub>O on gain per se. The time constant was unaffected either by voluntary suppression or by N<sub>2</sub>O. The reducing effect of N<sub>2</sub>O on voluntary non-visual suppression of VOR gain is assumed to be due to reduced alertness. Reduced voluntary non-visual suppression of VOR may imply reduced visual-vestibular interaction, which might be one explanation of the complaints of dizziness associated with fatigue or with ingestion of certain sedatives. Author

**A93-10330**  
**HEAT STRAIN DURING AT-SEA HELICOPTER OPERATIONS AND THE EFFECT OF PASSIVE MICROCLIMATE COOLING**

GUY R. BANTA and DANIEL E. BRAUN (U.S. Navy, Naval Health Research Center., San Diego, CA) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 881-885. refs

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Twelve Navy H-3 helicopter aircrew members were monitored (heart rate, skin, and rectal temperatures) in both microclimate cooling (ice) vest and non-vest conditions during at-sea operations in the high heat environment of the Persian Gulf. During all flights and flight phases, ambient dry bulb temperatures ranged from 31.0 C (in-flight) to 48.6 C (hover). Heart rate was greatest during hover and on-deck (range: 89.9 to 145.0 beats/min) without an ice vest, yet was significantly reduced with ice (range: 79.7 to 86.0 beats/min). Rectal temperature was not found to be different between vest and non-vest conditions; however, change across flight phases in both conditions was significant. Analysis of various demonstrated significantly lower mean weighted skin temperatures when wearing the ice vest. These data suggest that wearing a protective cooling vest can reduce the heat strain associated with helicopter flight in high heat environments. Author

## 52 AEROSPACE MEDICINE

**A93-10331**

### **THERMAL CONVERGENCE FAILS TO PREDICT HEAT TOLERANCE LIMITS**

S. A. NUNNELEY, M. J. ANTUNANO, and S. H. BOMALASKI (USAF, Armstrong Lab., Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 886-890. refs

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Work under very hot, humid conditions may raise skin temperature (T<sub>sk</sub>) to meet rectal temperature (T<sub>re</sub>). This convergence has been said to produce imminent collapse and therefore to predict human tolerance limits for work in heat, especially for those wearing impermeable protective clothing. The purpose of this study was to examine the ability of subjects to continue work beyond the time when they experienced convergence. A total of 15 healthy adult volunteers participated in two protocols: (1) each of nine subjects performed four experiments wearing impermeable clothing and walking on an inclined treadmill at a metabolic rate averaging 450 W with dry bulb temperature (T<sub>db</sub>) 29 or 38 C; (2) each of nine subjects performed eight experiments wearing heavy semipermeable clothing under a range of conditions involving T<sub>db</sub> = 22-40 C, relative humidity 15-88 percent, and work load = 200-500 W. Convergence occurred in 42 cases; in the majority (60 percent) the subject continued walking until T<sub>re</sub> rose to the criterion temperature 39 C, working for 10-45 min after convergence. No subject approached collapse, nor did convergence have any special effect on the rate of rise of temperature or heart rate. Thus, while convergence marks severe time-limited heat stress, it does not accurately predict tolerance limits in highly motivated subjects. Author

**A93-10332**

### **EFFECTS OF HYPOXEMIA AT SEA LEVEL AND HIGH ALTITUDE ON SODIUM EXCRETION AND HORMONAL LEVELS**

GERMAN RAMIREZ, MICHAEL HAMMOND, STEVEN J. AGOSTI, POLLY A. BITTLE, JOHN R. DIETZ, and GENE L. COLICE (James A. Haley VA Hospital; South Florida Univ., Tampa, FL; Dartmouth College, Hanover, NH; VAM & ROC, White River Junction, VT) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 891-898. Research supported by American Heart Association refs

(Contract NIH-HL-37235)

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Acute hypoxemia at sea level is associated with decreased aldosterone secretion. This inhibition is thought to be mediated through secretion of atrial natriuretic factor (ANF). The interaction of these two hormones should result in enhanced renal salt excretion during hypoxemic conditions. This hypothesis was tested by administration of a standardized salt load to seven normal subjects during normoxemia at sea level (SL), acute hypoxemia (AH) at sea level, and high altitude (HA, 3,000 m). Urine and venous blood samples were collected and analyzed. A natriuresis and diuresis was observed only under AH conditions. It was accompanied by a decrease in plasma aldosterone levels, but did not correlate with changes in plasma aldosterone levels, ANF, or other hormones. Increased plasma renin activity (PRA) and increased norepinephrine levels were encountered at HA, suggesting sympathetic nervous system activation. No change in anti-diuretic hormone (ADH) levels with increased plasma osmolality was seen at HA. We conclude that the differences observed in norepinephrine, PRA, and ADH levels during HA versus AH conditions suggest that hypobaric or chronic hypoxemia may influence these hormonal responses. Author

**A93-10333\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

### **THE INFLUENCE OF PRIOR EXERCISE AT ANAEROBIC THRESHOLD ON DECOMPRESSION SICKNESS**

K. V. KUMAR (Krug Life Sciences, Inc., Houston, TX), JAMES M. WALIGORA (NASA, Johnson Space Center, Houston, TX), and JOHN H. GILBERT, III (Krug Life Sciences, Inc., Houston, TX)

Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 899-904. refs

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This study was conducted to examine the effects of exercise prior to decompression on the incidence of altitude decompression sickness (DCS). In a balanced, two-period, crossover trial, 39 healthy individuals were each exposed twice, without denitrogenation, to an altitude of 6400 m in a hypobaric chamber. Under the experimental condition, subjects exercised at their predetermined anaerobic threshold levels for 30 min each day for 3 d prior to altitude exposure; the other condition was a non-exercise control. Under both conditions, subjects performed exercise simulating space extravehicular activities at altitude for a period of 3 h, while breathing 100 percent oxygen. There were nine preferences (untied responses) for DCS, four under control and five under experimental conditions; all were Type I, pain-only bends. No carry-over effects between exposures was detected, and the test for treatment differences showed  $p = 0.56$  for symptoms. No significant difference in DCS preferences was found after subjects exercised up to their anaerobic threshold levels during the days prior to decompression. Author

**A93-10335**

### **ASSESSING FOR PREFLIGHT PREDICTORS OF AIRSICKNESS**

PAUL D. LINDSETH and GLENDA N. LINDSETH (North Dakota Univ., Grand Forks) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 908-913. refs

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A total of 57 randomly selected male and female student pilots from a large aviation program of a midwestern university completed this study. These pilots were assessed for health status and surveyed for airsickness and associated symptoms by use of an Airsickness Inventory Questionnaire developed by the authors and a modified Self-Rating Anxiety Status Inventory Scale tool developed by Zung (1980). Correlational analyses of scores from self-report inventories were used to evaluate strength of relationships between airsickness and anxiety. Multiple linear stepwise regressions were computed on variables of correlated symptoms for predictiveness of airsickness. Results of the study indicated that 28.1 percent of pilots exhibited symptoms of airsickness. Significant correlations indicated moderate relationships between airsickness and the following preflight indicators: nausea and vomiting, tremors, face flushing, nightmares, urinary frequency, excessive nervousness, and anxiety index. Author

**A93-10336**

### **SPATIAL DISORIENTATION AND DYSFUNCTION OF ORIENTATION/EQUILIBRIUM REFLEXES - AEROMEDICAL EVALUATION AND CONSIDERATIONS**

JONATHAN B. CLARK (U.S. Navy, Naval Aerospace Medical Inst., Pensacola, FL) and ANGUS H. RUPERT (U.S. Navy, Naval Aerospace Medical Research Lab., Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 914-918. refs

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Loss of spatial awareness has been implicated as a direct causal factor in 4-10 percent of serious aircraft mishaps and 10-20 percent of fatal aircraft mishaps. Spatial disorientation in flight usually result from misperception of visual, vestibular, or proprioceptive cues. Pathologic causes have rarely been implicated. A student naval aviator with recurrent loss of spatial awareness due to a defective vestibulo-ocular reflex, presumably from vestibular neuronitis in adolescence, is reported. His chief complaint, an inability to focus on the instrument panel during turbulent instrument meteorological conditions, resulted in spatial disorientation and adverse flight attitude. A simple test of visual-vestibular interaction, the dynamic visual acuity test, could identify a defective vestibulo-ocular reflex in aviation personnel. An absent or defective vestibulo-ocular reflex has potential for disorientation in instrument flight. A comprehensive vestibular function test battery is indicated in individuals with recurrent or

overwhelming spatial disorientation who fail a screening dynamic visual acuity test. The aeromedical disposition of vertigo and dysequilibrium is discussed. Author

**A93-10337\*** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

**CORTICAL LOCALIZATION OF COGNITIVE FUNCTION BY REGRESSION OF PERFORMANCE ON EVENT-RELATED POTENTIALS**

R. W. MONTGOMERY, L. D. MONTGOMERY, and R. GUIASADO (Center for NeuroDiagnostic Study, Inc., San Jose, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 919-924. refs (Contract NAS1-18847)

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This paper demonstrates a new method of mapping cortical localization of cognitive function, using electroencephalographic data. Cross-subject regression analyses are used to identify cortical sites and post-stimulus latencies where there is a high correlation between subjects' performance and their cognitive event-related potential amplitude. The procedure was tested using a mental arithmetic task and was found to identify essentially the same cortical regions that have been associated with such tasks on the basis of research with patients suffering localized cortical lesions. Thus, it appears to offer an inexpensive, noninvasive tool for exploring the dynamics of localization in neurologically normal subjects. Author

**A93-10338**

**DOCUMENTATION OF ACTIVITY AND REST OF A U.S. NATIONAL GUARD ATTACK HELICOPTER BATTALION**

J. L. CALDWELL and RHONDA L. S. CORNUM (U.S. Army, Aeromedical Research Lab., Fort Rucker, AL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 925-929. refs

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A U.S. National Guard attack helicopter battalion was monitored in order to document the activity and rest obtained during the annual training exercises. A total of 39 soldiers wore wrist activity monitors during the 2-week training period. The data from these monitors discriminate activity from rest. Results indicated the following: (1) at some point during the exercises, everyone became sleep deprived; (2) the participants who received the most rest of the group were the enlisted headquarters personnel and the pilots; (3) the soldiers who received the least amount of sleep were the commander of the battalion and the maintenance personnel. Some recommendations are offered for future planning of National Guard training exercises. Author

**A93-11286**

**STUDY OF THE WHOLE-BODY RESPONSE TO VIBRATION: THE EFFECT OF REPEATED EXPOSURE TO THE LONG-TERM WHOLE-BODY VIBRATION. II**

AKIHIKO ONOZAWA, AKIRA ARAI, and YOSHIHIRO IWATA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858) vol. 32, no. 4 Dec. 1991 p. 113-124. In Japanese. refs

The effect of repeated exposure to the long-term whole-body vibration on the blood chemistry of an organism was investigated in rats exposed to  $\pm 2.5$  Gx, 20 Hz sinusoidal vibration with varying durations (3 hrs/day, 6 days/week) for 12 weeks. It was found that, during the vibration exposure period, hematocrit increased and hemoglobin concentrations tended to decrease; serum albumin, alpha-globulin, and albumin/globulin ratio increased; the blood urine nitrogen decreased; the CPK activity increased; and the LDH isoenzymes showed significant elevations. It is suggested that repeated exposures to whole-body vibration cause damage in the heart, lung, liver, skeletal musculature, and digestive system. I.S.

**A93-11675** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**ELECTRONYSTAGMOGRAPHY AND AUDIO POTENTIALS IN SPACE FLIGHT**

WILLIAM E. THORNTON (NASA, Johnson Space Center, Houston, TX), W. P. BIGGERS (North Carolina Univ., Chapel Hill), SAM L. POOL (NASA, Johnson Space Center, Houston, TX), W. G. THOMAS (North Carolina Memorial Hospital, Chapel Hill), and NORMAN E. THAGARD (NASA, Johnson Space Center, Houston, TX) Laryngoscope (ISSN 0023-852X) vol. 95, no. 8 Aug. 1985 p. 924-932. Research supported by NASA refs

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Beginning with the fourth flight of the Space Transport System (STS-4), objective measurements of inner ear function were conducted in near-zero G conditions in earth orbit. The problem of space motion sickness (SMS) was approached much like any disequilibrium problem encountered clinically. However, objective testing techniques had built-in limitations superimposed by the strict parameters inherent in each mission. An attempt was made to objectively characterize SMS, and to first ascertain whether the objective measurements indicated that this disorder was of peripheral or central origin. Electronystagmography and auditory brain stem response recordings were the primary investigative tools. One of the authors (W.E.T.) was a mission specialist on board the orbiter Challenger on the eighth shuttle mission (STS-8) and had the opportunity to make direct and personal observations regarding SMS, an opportunity which has added immeasurably to our understanding of this disorder. Except for two abnormal ENG records, which remain to be explained, the remaining ENG records and all the ABR records made in the weightless environment of space were normal. Author

**A93-11690**

**THE RESPONSES OF CARDIOVASCULAR DURING HEAD-UP TILT PLUS LOWER BODY NEGATIVE PRESSURE**

XIAN-YUN SHEN, SHU-CHUN LI, QIU-LU XIANG, JING-RUI MENG, XIAO-XIA YAN, YA-ZHI SUN, LI-HUA XU, YA-MIN FAN, and XIANG-CHANG ZHUANG (Inst. of Space Medico-Engineering, Beijing, China) Chinese Journal of Space Science (ISSN 0254-6124) vol. 11, no. 3 July 1991 p. 226-234. In Chinese. refs

A method of head-up tilt plus lower body negative pressure (HUT-LBNP) is used in simulating the stress of gravity upon crewman after returning to the earth from spaceflight, in order to study the regulatory function of cardiovascular system. The subjects are 20 healthy young men. The examination consisted of a simple HUT (75 deg) experiment, run twice, each lasting 20 min and two times of HUT-LBNP, the latter at -5333 Pa LBNP, with subjects in supine position on a tilt table for 2 min, after which the subjects were turned to HUT for 20 min, while the LBNP was maintained. Four types of regulation are found, according to the responses of the subjects in terms of the heart rate, peripheral resistance, and tolerance time during HUT-LBNP. These are vessel-type, mixed-type, heart-type, and underregulation-type. Author

**A93-12862**

**THE VALUES OF THE SKIN-TEMPERATURE GRADIENTS AND THEIR SIGNIFICANCE FOR THERMOREGULATION [VELICHINY TEMPERATURNYKH GRADIENTOV V KOZHE I IKH ZNACHENIE DLIA TERMOREGULIATSII]**

N. A. SLEPCHUK and K. P. IVANOV (Russian Academy of Sciences, Inst. of Physiology, St. Petersburg, Russia) Fiziologicheskii Zhurnal (ISSN 0015-329X) vol. 78, no. 1 Jan. 1992 p. 80-84. In Russian. refs

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The values of temperature gradients between the skin surface and its deep (2-3 mm from the surface) layers were measured in human subjects under conditions of varying muscle activity and ambient temperature. It was found that, when the ambient temperature was lowered from 32-34 C to 15-17 C, the values of the temperature gradient in the skin increased from 0.13  $\pm$  0.1 to 1.29  $\pm$  0.13 C; the temperature gradient in the skin increased

in the first five minutes of muscle activity, but with time the increase flattened out. I.S.

**A93-12969**

**THE PROSPECTS FOR THE IMPROVEMENT OF MEDICAL MONITORING OF THE HEALTH OF FLIGHT PERSONNEL IN A MILITARY UNIT [PERSPEKTIVY SOVERSHENSTVOVANIYA MEDITSINSKOGO KONTROLIA ZA SOSTOIANIEM ZDOROV'IA LETNOGO SOSTAVA V VOJSKOVOM ZVENE]**

V. V. LAPA, N. I. FROLOV, and P. M. SHALIMOV  
Voенно-Meditsinskii Zhurnal (ISSN 0026-9050) no. 3 March 1992 p. 45-47. In Russian.

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Approaches used up to now in supervising the health condition of flight personnel are discussed. It is pointed out that, aside from the detection of an already present pathological condition (as is being done at present), it is also important to evaluate the physiological anomalies which might make the individual susceptible to acquiring health problems in the future. An automated system is described for health assessment from results of periodic medical examinations. The system makes the assessment on the basis of parameters which characterize the anthropometric characteristics, the state of the cardiovascular system, and the lipid metabolism of the individual. The assessment is also based on functional stability as determined from four functional-load tests and on psychophysiological and psychological characteristics determined from a battery of sensomotor tests, as well as the characteristics of attention, memory, and spatial thinking. The tests also include a questionnaire for self-evaluation of well-being. I.S.

**A93-13529**

**EXPERIMENTAL RESEARCH OF THE TEMPERATURE AND HUMIDITY CONTROL SYSTEM FOR MANNED SPACECRAFT CABIN**

YUNYU MENG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 11-16. In Chinese. refs

Temperature and humidity control system is an important part of the life support system in space capsule. This paper describes the study of a test system which consists primarily of spacesuit circuit, cabin circuit and liquid coolant loop. It was tested in a simulated capsule in which the operational conditions were 4.7 cu m volume, 101.55, 30.7 kPa pressure, 1610-1804 kJ/h heat load and 150-363 g/h moisture production rate. The system was found to be capable of controlling the temperature and relative humidity within the range of 16.3-24.5 C and 51-89 percent, respectively.

Author

**A93-13531**

**EFFECTS OF SUSTAINED +GZ STRESS ON BAEP IN WAKED RABBITS**

YUNLONG ZHOU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 22-26. In Chinese. refs

Brain-stem auditory evoked potentials (BAEP) in waked rabbits were observed during different levels of +Gz stress. The results showed that there was no obvious effect at lower G stresses on the latencies of BAEP. The latency of BAEP wave 1 delayed significantly during +5, +6, and +7 Gz stresses, but the interwave latency (1-5) remained essentially unchanged. The amplitude and frequency characteristics of BAEP were influenced to a certain extent. The effects of sustained +Gz stress on BAEP might be related to the hemodynamic changes at brain level and the unique peripheroceptive stimuli during G stress. The results may provide reference for performance studies during G stresses. Author

**A93-13533**

**A STUDY OF BIOLOGICAL EFFECTS AND CHARACTERISTICS OF DYNAMIC RESPONSES OF ORGANISM ON LANDING IMPACT**

YULAN WANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 32-37. In Chinese. refs

In order to study biological effects and biodynamics of organism on landing impact, 8 healthy young men and 25 dogs, in sitting position, were exposed to 15-30 G for 30-80 ms and 30-100 G for 10-100 ms, respectively. During the experiments, accelerations on the seat, iliac crest, shoulder and head, ECG, EEG, SEP and displacement of body were recorded. What were obtained from the experiments are as follows: characteristics of animal's injury and tolerance to high G impact; human physiological responses and tolerance to impact; correlation among the dynamic responses of different parts of human body, transfer ratio and essential impact factors; correlation of human body displacement to injury; comparison among the characteristics of dynamic responses of human body, dummy and animal, as well as the three types of impact waves. Author

**A93-13704**

**EFFECTS OF ANTIMOTION SICKNESS DRUG MIXTURE B ON ULTRASTRUCTURES OF CEREBRAL AND CEREBELLAR CORTEXES IN SUSPENDED RABBITS**

JINGQUAN LAN (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 157-161. In Chinese. refs

The ultrastructural changes of neurons of cerebral and cerebellar cortex in rabbits were studied with electron microscopic technique. The animals were divided into control and drug-treated groups and were suspended in head-down 20-deg tilt for 3, 7, and 15 days. The changes taking place in 3-day suspension were most obvious: mitochondria of neurons in cerebral cortex swelled, cristae split, and matrix became dilute; degeneration of granular endoplasmic reticulum of Purkinje's cells in the cerebellar cortex was observed, the length of cisterns of endoplasmic reticulum shortened, and the cisterns clustered closely and gathered at the peripheral portion of the cells. The antimotion sickness drug mixture B (mixture of anisodine and d-amp-phetamine) protected the neurons of brain from the damage by suspension. The reason of the damage on ultrastructures of neurons is analyzed, and the mechanism of motion sickness and the pharmacologic role of the mixture B is discussed. Author

**A93-13705**

**VALUE OF FREQUENCY DOMAIN CORRELATIVE CARDIOGRAPHY (FCG) TO EARLY DIAGNOSIS OF CORONARY HEART DISEASE**

YUANHUAI ZHAO (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 162-168. In Chinese. refs

FCG is a new noninvasive method of CAD diagnosis. In order to evaluate the clinical value of FCG to early diagnosis of CAD, a comparison of FCG with ECG among 92 cases of CAD or dubious CAD (71 males and 21 females with average age of 49) was made on the basis of radionuclide angiocardiology. The results showed that the overall coincident rate and positive rate of FCG were 20.65 and 25.34 percent higher than those of ECG, respectively. The difference in the rates between the two methods was statistically very significant. Author

**A93-13706**

**CHARACTERISTICS OF HEART RATE RESPONSE (HRR) IN YOUNG MEN DURING EXERCISE**

GUOXUAN ZHAO (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 169-175. In Chinese. refs

Characteristics of HRR were studied in 36 young men during exercise with bicycle ergometer. Indices of the regulative function of the cardiovascular system and physical ability for evaluation were drawn from the tendency of their heart rate responses, and an empirical formula was established. According to the formula, the subjects could be divided into five types, of which those who had excellent response tendency of heart rate (Type I) had scores for both of the indices. As compared with the results from a

review study, good consistency was demonstrated between the classification with this method and the results from other kinds of cardiovascular function tests. Author

**A93-13707****EFFECTS OF DIFFERENT INHALANT O<sub>2</sub> CONCENTRATIONS ON VENTILATORY AND HEART RATE KINETIC RESPONSES DURING EXERCISE**

RUGUO ZHANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 176-179, 198. In Chinese. refs

Ten healthy young men participated in the exercise experiment performed on a bicycle ergometer with 125 W workload. The ventilatory and heart rate (HR) dynamic responses were continuously observed during exercise and recovery periods. According to the oxygen concentrations in inspired gas the subjects were divided into three groups: 14 percent O<sub>2</sub>, 21 percent O<sub>2</sub>, and 60 percent O<sub>2</sub>. The satisfactory results were obtained by using second-order exponential equations to imitate the changes of ventilatory and HR responses. The changes could modally be divided into fast and slow components, of which the values and times for stabilization had a certain significance to physiological evaluation of respiratory and circulatory functions. Author

**A93-13708****EFFECTS OF +GZ STRESS ON MEDIUM- AND LONG-LATENCY AUDITORY EVOKED RESPONSES**

YUNLONG ZHOU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 180-183. In Chinese. refs

In order to investigate the effects of +Gz stress on brain function, the medium- and long-latency auditory evoked responses were analyzed in conscious rabbits during different levels of +Gz stress. The results showed that the effects varied at different levels of the specific auditory system, and that higher C stresses had serious influences upon SCR. It reflected that there might be detrimental effects on the integrative function of brain. Author

**A93-13710****PHARMACOLOGICAL EFFECTS OF MIXTURE OF ELEUTHEROCOCCUS (ELE) AND ELSCHOLTZIA (ELS)**

CHEONGLIN LIU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 187-192. In Chinese. refs

Pharmacological effects of ELE, ELS, and their mixture (per os) were observed in a series of experiments (10 to 110 days) in mice, rats, and human. The effects of the mixture included enhancement of the endurance of mice to cold and alcohol, improvement of the immune function of the Yin-deficiency and Yang-deficiency mice, inhibition of the lipid peroxidation of liver and cerebral cortex of old rats, decrease of the NA content of cerebral cortex of old male rats, and regulation of the level of serum lipids of old female rats and hyperlipemic human subjects, especially an increase of the serum content of HDL-C. The inhibiting effect of the mixture on lipid peroxidation was observed only after ELE and ELS were mixed, while the regulating effect of the mixture on serum lipids was mainly the effect of ELE. Author

**A93-13711****EXPERIMENTAL STUDY OF VOLATILE METABOLITES OF HUMAN BODY**

BINGLIANG YU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 193-198. In Chinese. refs

Volatile metabolites in human expired air and secretion from skin were monitored qualitatively and quantitatively using GC-MS technique as well as an improved concentration technique with polymer absorbent. Fifty six and 13 chemical components were identified, respectively. The distribution range and characters of the concentrations of expired air components were obtained. The characteristics of the effects on the concentration of expired air

components during light physical work was also observed. The quantity and quality of the expired air components were not influenced by high-temperature environment in short time. The organic acids of low carbon chain, esters, and ammonia in volatile components of skin secretion are important sources of odor of the sweat. The individual and distributive differences in the concentrations of skin volatile components were observed. These will provide important basis for designing air purification system and formulating hygienic standards of closed environment. Author

**A93-13713****DESIGN OF ION SOURCE OF RESPIRATORY MASS SPECTROMETER**

SHENGGUO XU (Inst. of Space Medico-Engineering, Beijing, China) Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 203-209. In Chinese. refs

When analysis of breath-sample gas is made using a general residual gas mass spectrometer, a distortion in measurement of N<sub>2</sub> and CO<sub>2</sub> samples occurred due to formation of CO and CO<sub>2</sub>, which is caused by the chemical reaction of the gases present at the filament with each other or with the materials on the hot surface of the emitter. The effects of the distortion on measurements can be reduced by improving the design of the conductance aperture of ionizing chamber of ion source and by selecting the materials of the filament and electrodes. A respiratory mass spectrometer was developed based on these principles, which worked well under various experimental conditions. Author

**A93-13714****SUBTRACTION OF 50 HZ INTERFERENCE FROM ELECTROCARDIOGRAM BY USING CYCLE AVERAGING METHOD**

MAOQI HU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 3 1990 p. 210-213. In Chinese. refs

A new method, cycle average technique, was developed for subtraction of 50 Hz (or 60 Hz) interference from the electrocardiogram. It is simple and does not introduce 'ringing' effect. It can be used in real-time display or processing of ordinary ECG or vector ECG recordings. Author

**A93-13715****THE EVALUATION OF TOLERANCE TO SERIOUS ACUTE HYPOXIA IN HUMANS**

GUOLIN XU (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 235-239. In Chinese. refs

15 young men breathed gas mixture containing 7.1 percent oxygen that simulated hypoxia at 7500m altitude to examine the tolerance to hypoxia. Time of useful consciousness (TUC) was measured with a method of letting the subjects count down by writing while recording their vigil EEGs. After the measurement of TUC, an auditory test under simulated hypoxia was conducted. The average response time was twice as much as that of control. At the terminal of TUC, the oxygen partial pressure at tidal end in expired gas was 4.0 +/- 0.2kPa. In one minute after that, this partial pressure became 3.7 +/- 0.2kPa. At this time the subjects could still reply to sound signals using a push button. The results are significant to emergency rescue. Author

**A93-13716****STUDY OF THE RELATIONSHIP BETWEEN THERAPEUTIC EFFECTS AND CONTROL PARAMETERS OF ECP USING A SIMULATION METHOD**

JING BAI (Tsinghua Univ., Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 240-244. In Chinese. refs

Further improvements were made on our modelling of cardiovascular dynamics based on our previous work. New and more realistic conceptions of coronary artery and vascular wall collapse mechanism have been correlated into the model to make

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it more suitable for the study of the external counterpulsation (ECP) mechanism. Some preliminary simulation experiments made with this new model have been performed. The results show that a proper choice of control parameters for ECP device is very important. In timing deflation, considerations should be given to both the aspects of cardiac work and coronary perfusion. Neither should be overemphasized at the expense of the other. The results obtained with this model are in agreement with the existing clinical data. Author

**A93-13719**

**A STUDY OF HUMAN BRAIN SOMATOSENSORY EVOKED POTENTIAL AND ITS APPLICATION TO MAN-MACHINE-ENVIRONMENT SYSTEM ENGINEERING - PRELIMINARY EXPLORATION OF SEP IN NORMAL ADULT**

ZILONG CHENG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 4 1990 p. 256-260. In Chinese. refs

Impact deceleration causing pain and injury in humans is often encountered by astronauts during launch, reentry, and landing. This study was carried out to explore objective indices for judging acute pains. The results show that SEP of a normal adult is stable. It has laid a good foundation for further studies and applications. Author

**N93-10075\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 365)**

Aug. 1992 74 p  
(NASA-SP-7011(365); NAS 1.21:7011(365)) Avail: CASI HC A04

This bibliography lists 211 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during July 1992. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

**N93-10076\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 360)**

Mar. 1992 78 p  
(NASA-SP-7011(360); NAS 1.21:7011(360)) Avail: CASI HC A05

This bibliography lists 217 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during February 1992. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

**N93-10077\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 364)**

Jul. 1992 71 p  
(NASA-SP-7011(364); NAS 1.21:7011(364)) Avail: CASI HC A04

This bibliography lists 188 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during June 1992. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

**N93-10079\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 366)**

Sep. 1992 82 p  
(NASA-SP-7011(366); NAS 1.21:7011(366)) Avail: CASI HC A05

This bibliography lists 248 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System during Aug. 1992. Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Author

**N93-10080\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 367)**

Oct. 1992 73 p  
(NASA-SP-7011(367); NAS 1.21:7011(367)) Avail: CASI HC A04

This bibliography lists 205 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System during Aug. 1992. Subject coverage includes the following: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

**N93-10222#** International Atomic Energy Agency, Vienna (Austria).

**FORMAT AND STRUCTURE OF A DATABASE ON HEALTH AND ENVIRONMENTAL IMPACTS OF DIFFERENT ENERGY SYSTEMS FOR ELECTRICITY GENERATION**

Apr. 1992 232 p  
(DE92-634160; IAEA-TECDOC-645) Avail: CASI HC A11/MF A03

There is considerable interest in the application of techniques of comparative risk assessment in the planning of energy mixes for electricity generation, and particularly in the integration of health and environmental impacts in the decision-making process. To assist this it is planned to establish an internationally coordinated database on the health and environmental effects of different energy sources. This document introduces the structure and format of the database, and contains in addition eighteen papers prepared for Technical Committee Meetings to discuss the proposed database. DOE

**N93-10271#** Pennsylvania Univ., Philadelphia.

**COMPUTER SIMULATIONS OF OBJECT DISCRIMINATION BY VISUAL CORTEX**

PAUL SAJDA and LEIF H. FINKEL 3 Jan. 1992 12 p  
(Contract N00014-90-J-1864)  
(AD-A253345) Avail: CASI HC A03/MF A01

We present computer simulations of how the visual cortex may discriminate objects based on depth-from-occlusion. We propose neural mechanisms for how the visual system binds edges into contours, and binds contours and surfaces into objects. The model is simulated by a system of physiologically-based neural networks which feature feedback connections from higher to lower cortical areas, a distributed representation of depth, and phase-locked cortical neuronal firing. The system demonstrates psychophysical properties consistent with human perception of real and illusory visual scenes. The model addresses both the binding problem and the problem of object segmentation. GRA

**N93-10438#** Versar, Inc., Springfield, VA.

**DERMAL EXPOSURE ASSESSMENT: PRINCIPLES AND APPLICATIONS Interim Report**

Jan. 1992 392 p  
(Contract EPA-68-D00101)

(PB92-205665; OHEA-E-367; EPA/600/8-91/011B) Avail: CASI HC A17/MF A04

The purpose of the document is to describe the principles of dermal absorption and show how to apply these principles in actual human exposure scenarios. The primary focus of the document is on dermal contact with water, soils, and vapors. For each of these media, the experimental data on the dermal properties of specific compounds are summarized and methods are provided for predicting these properties when data is lacking. Additionally, scenario factors describing the frequency, duration, and intensity of contact are presented for the soil and water media. GRA

**N93-10613#** Armed Forces Radiobiology Research Inst., Bethesda, MD.

**DOD SPACE RADIATION CONCERNS Annual Program Review No. 3**

MICHAEL J. GOLIGHTLY and DANIEL L. COLLINS 15 Jul. 1992 20 p

(AD-A253135) Avail: CASI HC A03/MF A01

Potential manned military space missions would involve exposing crews to many environmental factors, including ionizing radiation. Ionizing radiation in space comes from several natural and man-made sources. Many parameters influence the radiation dose crews would receive and the biomedical outcome of the exposure. A systematic approach has been developed to examine military space crew doses and its impact on mission objectives. The approach involves determining mission and orbital parameters from analysis of preliminary spaceflight operational concepts and objectives, the types of radiation qualities and dose rates to which crews would be exposed, the critical crew functions, and the resulting impact of the projected radiation exposure. From this analysis and a review of the current space radiobiology database, areas requiring further information or research are identified. An initial space radiobiology research program has been outlined. The resulting Space Radiation Effects Study Program has been incorporated into the current DoD 5-Year Plan for Ionizing Radiation Biomedical Research. GRA

**N93-10626#** Inhalation Toxicology Research Inst., Albuquerque, NM.

**UNDERSTANDING MECHANISMS OF CARCINOGENESIS USING RAT TRACHEAL EPITHELIAL CELLS IN VITRO**

DAVID G. THOMASSEN 1992 7 p Presented at the Symposium on Current Concepts and Approaches on Animal Test Alternatives, Aberdeen Proving Grounds, MD, 4-6 Feb. 1992

(Contract DE-AC04-76EV-01013)

(DE92-013510; CONF-9202107-1) Avail: CASI HC A02/MF A01

In vitro transformation assays are used to increase understanding of mechanisms of carcinogenesis and to determine the transforming potency of individual agents. While these assays can provide information on the mechanism for specific steps in the carcinogenic process or can predict the carcinogenic potency of a given toxicant, the relevance of in vitro endpoints or response for carcinogenesis must be determined. This paper will focus on the utility of an in vitro system for understanding the mechanisms of multistage respiratory carcinogenesis and on considerations that are critical for its use and application. DOE

**N93-10650#** Loyola Univ., Chicago, IL. Hearing Inst.

**AUDITORY PROCESSING OF COMPLEX SOUNDS ACROSS FREQUENCY CHANNELS Final Technical Report, 1 May 1989 - 30 Apr. 1992**

WILLIAM P. SHOFNER, RAYMOND H. DYE, and WILLIAM A. YOST 26 Jun. 1992 24 p

(Contract AF-AFOSR-0335-89)

(AD-A253612; AFOSR-92-0714TR) Avail: CASI HC A03/MF A01

The research supported by this grant is directed towards gaining an understanding how the auditory system processes complex sounds. The results of binaural psychophysical experiments in human subjects suggest (1) that spectrally synthetic binaural processing is the rule when the number of components in the tone complex are relatively few (less than 10) and there are no dynamic binaural cues to aid segregation of the target from the

background, and (2) that waveforms having large effective envelope depths are on the average more easily lateralized than those having small effective envelope depths. Psychophysical experiments in human subjects using sinusoidally amplitude modulated narrowband noises and complex patterns of modulation of tonal carriers have been directed toward understanding auditory object perception. Results from experiments and theoretical modelling suggest that slow temporal modulation of different spectral components can be used by the auditory system to fuse these components into one auditory image. The results of psychophysical experiments show that the effects of noise bandwidth on intensity discrimination of noise in chinchillas are similar to data from human subjects; the results can be accounted for by a modification of the ideal energy detector. Neurophysiological experiments have been directed at gaining an understanding of how auditory neurons encode pitch related information in the temporal properties of discharge. The results show that a temporal representation at the level of the cochlear nucleus can account for some, but not of the pitches of rippled noise. GRA

**N93-10661#** University of Northern Arizona, Flagstaff. Coll. of Health Professions.

**EFFECTS OF EARLY BRIGHT, LATE BRIGHT AND DIM ILLUMINATION UPON CIRCADIAN NEUROENDOCRINE, ELECTROPHYSIOLOGICAL AND BEHAVIORAL RESPONSES**

**Final Report, May 1991 - May 1992**

PATRICK R. HANNON, GEORGE BRAINARD, WILLIAM GIBSON, JONATHAN FRENCH, and MARGARET HOPSON 29 Jul. 1992 58 p

(Contract AF-AFOSR-0271-91)

(AD-A254129; AFOSR-92-0793TR) Avail: CASI HC A04/MF A01

This study assessed the effects of bright light on biological and behavioral measures to determine if bright light can reduce fatigue and enhance human work performance. Female subjects (N=37) were exposed to one of 3 lighting conditions in a between groups research design. Subjects in the bright light groups were exposed to 5000 lux white light from 1800 hrs to 2400 hrs (Early Bright) or from 2400-0600 hrs (Late Bright from 1800-0600 hrs Dim Red). Blood sample were taken every 90 minutes. Repeated measures ANOVA indicated a significant interaction effect (light x time) for tympanic temperature, (F=3.339, p=.001). The bright light conditions maintained higher tympanic temperatures from 2300 hrs through 0400 hrs. Plasma melatonin measures indicated a main effects difference of F=4.009, p=.029. Most importantly, the results showed that the light x time of night interaction for melatonin was significant at F=59.436, p=.000. The suppression of plasma melatonin was greatest from 2230 hrs through 0500 hrs in the Early Bright and Late Bright groups. Cortisol was not affected by the ambient lighting conditions. Dim red light resulted in higher scores on the Stanford Sleep Scale from 2400 hrs through 0500 hrs (light x time, F= 2.595, p=.023). Subjects under the bright light conditions performed better on the cognitive measures of Code Substitution accuracy (F=3.918, p=.030) and Column Addition accuracy (F=4.660, p=.017). These data show some improvements in cognitive performance and alertness associated with bright light exposure and occur with changes in tympanic temperature and plasma melatonin at critical time periods. GRA

**N93-10709#** Keller Army Community Hospital, West Point, NY.

**A PROSPECTIVE EVALUATION OF STRESS FRACTURES/OVERUSE INJURIES IN A POPULATION OF WEST POINT CADETS Annual Report, 1 Dec. 1990 - 30 Nov. 1991**

JAMES H. SWAIN 15 Jan. 1992 4 p

(Contract MIPR-91M1502; DA PROJ. 3M2-63002-D-840)

(AD-A252427) Avail: CASI HC A01/MF A01

The study group performed two evaluations during this period. The 175 Cadets remain in the study. Nonparticipant are primarily due to resignation from the Academy. Body fat percent for the men and women has remained the same. The women have increased weight indicating a gain in muscle mass. Lower extremity injuries have equalized in the two groups. There were more injuries

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in men (32 percent) than in women (27 percent) from January to August 1991. Bone density and laboratory values are being automated presently. GRA

**N93-10765#** Massachusetts General Hospital, Boston.  
**COGNITION IN THE BRAIN: INVESTIGATIONS USING  
POSITRON EMISSION TOMOGRAPHY Final Technical Report**  
NATHANIEL M. ALPERT 16 Jul. 1992 17 p  
(Contract AF-AFOSR-0029-91)  
(AD-A254280; AFOSR-92-0766TR) Avail: CASI HC A03/MF A01

The goal of this workshop was to identify and begin a continuing discussion of the major issues affecting the generation and testing of new hypotheses about cognitive processing. The workshop covered three major topics: (1) anatomic localization of components of cognitive processing; (2) issues of data analysis arising from cognitive function experiments; and (3) task design in cognitive function studies with PET. GRA

**N93-10796#** Army Medical Center, Fort Gordon, GA.  
**METABOLIC FACTORS INFLUENCING MYOCARDIAL  
RECOVERY FROM ACIDOSIS (CIC3) Final Report, 15 Mar.  
1991 - 14 Mar. 1992**

JOSEPH I. SHAPIRO, JESSE DOERS, RICHARD F. KUCERA, M.  
MCCORMICK, and NANCY ELKINS 10 Apr. 1992 17 p  
(Contract MIPR-91MM1533; NR PROJ. 3M1-61102-BS-87)  
(AD-A252376) Avail: CASI HC A03/MF A01

The mechanisms involved in cardiac dysfunction during acidosis were explored in an isolated heart model. Metabolic acidosis was observed to cause marked functional and energy metabolic derangement consistent with a primary impairment of energy production. Synergism with hypoxia was also demonstrated in this model. The site of metabolic blockage during acidosis was observed to be at the level of oxidative metabolism and not glycolysis. Isolated cardiac mitochondrial studies, however, did not demonstrate any direct effect of acidosis on mitochondrial respiration or coupling. Studies with respiratory acidosis were complicated by the coexistence of relative hypoxia which affected the model deleteriously. Treatment of acidotic isolated hearts with the experimental buffer, Carbicarb, caused marked increases in intracellular pH as well as functional and metabolic improvements. Isotonic rather than hypertonic Carbicarb was found to be substantially more effective in this model. The superiority of isotonic to hypertonic Carbicarb may be related to the tendency of hypertonic but not isotonic Carbicarb to significantly increase cytosolic sodium concentrations. GRA

**N93-11146#** Princeton Univ., NJ.  
**PHYSIOLOGICAL ANALYSES OF THE AFFERENTS  
CONTROLLING BRAIN NEUROCHEMICAL SYSTEMS Annual  
Report, 1 Jun. 1991 - 31 May 1992**  
BARRY L. JACOBS 30 Jun. 1992 3 p  
(Contract AF-AFOSR-0294-90).  
(AD-A253185; AFOSR-92-0734TR) Avail: CASI HC A01/MF A01

Two types of experiments are described. The first was directed at the neurochemical systems that control the activity of brain serotonergic (dorsal raphe nucleus) neurons. The second examines the effects of serotonin and norepinephrine on the activity of target neurons carrying out sensory information processing or motor function. Both sets of studies utilize single unit activity in combination with multibarrel microiontophoresis in awake animals. This research program provides critical links for understanding both the control of brain neurochemical systems and the control exerted by them. This will help to elucidate, more broadly, the role of these modulatory brainstem neurochemical systems in processes such as state-dependent changes in physiology and behavior, and arousal and attention. GRA

**N93-11193#** Cryopharm Corp., Pasadena, CA.  
**FREEZE-DRIED HUMAN RED BLOOD CELLS Progress Report**  
15 Jul. 1992 49 p  
(Contract N00014-90-C-0053)  
(AD-A253295) Avail: CASI HC A03/MF A01

A preliminary clinical evaluation of *in vivo* circulation of

autologous, lyophilized and reconstituted human red blood cells was undertaken to establish a baseline level of *in vivo* performance of lyophilized red blood cells from both human volunteers and cynomolgus monkeys. The cell survival results demonstrated that reconstituted, lyophilized red cells remained in circulation *in vivo* for the same period as normal non-lyophilized red blood cells. Since our last progress report we have obtained additional *in vivo* survival data from a total of four healthy volunteers. The design of the clinical study protocol followed accepted procedures for red cell *in vivo* survival studies. In all of the four volunteers, no changes in vital signs occurred after an infusion of a small dose of the autologous lyophilized red blood cells and no associated adverse side effects were observed during the study and through the final follow-up examination conducted one week post infusion. In all four volunteers, peripheral blood samples were collected in citrate-phosphate-dextrose and adenine-1 (CPDA-1) for up to 6 days post infusion to measure the level of circulating chromium labeled red cells and to allow accurate estimation of the circulating half lives of the cells. Urine sample collection was also carried out during the first 24 hours post infusion for measurement of the levels of chromium clearance by the kidneys. Each volunteer was subjected to gamma imaging and external probe counts over the heart, spleen and liver at 4 hours and 24 hours post-infusion to determine the organ distribution of the radiolabeled reconstituted red blood cells. GRA

**N93-11283#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

**ALLERGIC, IMMUNOLOGICAL AND INFECTIOUS DISEASE  
PROBLEMS IN AEROSPACE MEDICINE [LES PROBLEMES  
CAUSES PAR LES MALADIES ALLERGIQUES,  
IMMUNOLOGIQUES ET CONTAGIEUSES EN MEDECINE  
AEROSPATIALE]**

Apr. 1992 211 p In ENGLISH and FRENCH Symposium held in Rome, Italy, 21-25 Oct. 1991  
(AGARD-CP-518; ISBN-92-835-0664-2) Copyright Avail: CASI HC A10/MF A03

These proceedings include the technical evaluation report, the opening address, and 36 papers of the symposium. The theme of the symposium was the fight against infectious diseases, mainly the vaccine-preventable ones, and the study of inhalent allergic diseases. Enormous development in the last few years has allowed us to understand and prevent many pathological conditions, whereas the setting up of laboratory tests has allowed us to monitor with great precision the immune function which may be depressed by the environmental stimuli to space or military flight. Lastly, the development of military and civilian air travel, which favors the spreading of infectious and parasitic diseases, requires the setting up of correct prophylactic measures.

**N93-11284#** Eidgenoessische Technische Hochschule, Zurich (Switzerland). Space Biology Group.  
**SPACE FLIGHT AND IMMUNE SYSTEM**  
A. COGOLI /n AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 10 p Apr. 1992  
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Depression of lymphocyte response to mitogens in cosmonauts after spaceflight was reported for the first time in the early seventies by Soviet immunologists. Today we know that depression of lymphocyte function affects at least 50 percent of space crew members. Investigations on the ground on subjects undergoing physical and psychological stress indicate that stress is a major factor immune depression of astronauts. This despite the fact that weightlessness per-se has a strong inhibitory effect of lymphocyte activation *in-vitro*. Although the changes observed never harmed the health of astronauts, immunological changes must be seriously investigated and understood in view of long duration flights on space stations in an Earth orbit and to other planets like Mars and the Moon. Author

**N93-11285#** Defence and Civil Inst. of Environmental Medicine, North York (Ontario).

**MECHANISMS OF IMMUNE FAILURE IN BURN INJURY**

BRIAN G. SPARKES *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 12 p Apr. 1992

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The burden on military medical services in handling burn casualties is daunting as all physiological systems will become affected. Severe burns in a battlefield setting have a very low salvage rate, to a great degree because of the immune failure which invariably develops. Evaluations of responses of lymphocytes taken from burn patients over several weeks following the burn (greater than 30 percent TBSA), have revealed that the immune failure which follows thermal injury involves T cell activation events. Interleukin 2, which is normally produced by activated T lymphocytes, is very poorly produced by cells cultivated in vitro taken from non-surviving patients, whereas some production continues, although at below normal levels, in patients who ultimately survive their injury. IL2 exogenously added to lymphocyte cultures enhances the proliferation of cells from surviving patients but gives no such help to cells from nonsurvivors. The TAC portion of the IL2 receptor (IL2R alpha), expressed on the T cell surface, appears to be responsible for this difference, as the number of lymphocytes able to express IL2R alpha falls post-burn. A lipid protein complex (LPC) produced in skin by burning has been shown to inhibit the immune response in vivo and the growth of IL2-dependent lymphocytes in culture. Cerium nitrate, applied topically to the burn patient, is thought to fix the LPC in the burn eschar and prevents its entry into the circulation. In a study of 10 patients, bathed in cerium nitrate, some T lymphocyte activities were found to be in the normal range rather than suppressed. Such a treatment promises to be useful in improving chances of survival in severe burn injury. Author

**N93-11286#** Turin Univ. (Italy).

**CLINICAL TYPES OF HEPATITIS B**

MARIO RIZZETTO and ROBERTO NISINI (Divisione Aerea Studi Ricerche e Sperimentazioni, Pratica di Mare, Italy) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 7 p Apr. 1992

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Hepatitis B is a parenterally and sexually transmitted disease of global importance. The disease runs more frequently a subclinical and anicteric course, with a significant rate of cases that become chronic. Chronic hepatitis may progress to cirrhosis or cancer. The strategies by which Hepatitis B can be diminished and eventually eliminated are: immunization, measures to prevent exposure to infective blood or blood derivatives, and education (in particular awareness that hepatitis B is a sexually transmitted disease). Author

**N93-11287#** Aerospace Medical Research Labs., Brooks AFB, TX. Epidemiologic Research Div.

**VIRAL HEPATITIS IN THE US AIR FORCE, 1980 - 1989**

M. D. PARKINSON, R. W. STOUT, D. R. MAHON, W. F. CLARDY, R. W. WARNER, M. E. WESTON, and W. H. WOLFE *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 2 p Apr. 1992

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Viral hepatitis and its acute and chronic complications continue to pose significant threats to the readiness of military personnel. Knowledge about the specific viral agents and their routes of transmission are important in developing prevention strategies. A recent analysis of hepatitis in the U.S. Navy for the period 1975-1984 is reviewed. In order to better characterize the risk of viral hepatitis among Air Force personnel, a comprehensive review of inpatient and quarters data for hepatitis A, B and 'non-A, non-B' were reviewed from Air Force medical treatment facilities worldwide for the period 1980-1989. Following a discussion of the study methodology, preliminary data and hepatitis type-specific demographic risk variables are discussed. Preliminary results from

a hepatitis serosurvey (A, B, and C antibody with use of a supplemental validating assay) of the subset of the study cohort who are currently on active duty are briefly reviewed. Author

**N93-11288#** Zurich Univ. (Switzerland). Div. of Epidemiology and Prevention of Communicable Diseases.

**HEPATITIS A AND HEPATITIS B: RISKS COMPARED TO OTHER VACCINE PREVENTABLE DISEASES AND IMMUNIZATION RECOMMENDATIONS**

R. STEFFEN *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992

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The incidence rate of hepatitis A is 3(-6)/1000 per month of stay in a developing country in unprotected travelers. Trampers and other persons feeding themselves under bad hygienic conditions have a rate of 20/1000. In many industrialized countries, persons below the age of 50 years have a seroprevalence rate of anti-HAV less than 20 percent. Hepatitis A morbidity and mortality in travelers is far greater than the one of any other vaccine preventable infection in travelers, with the exception that hepatitis B shows a slightly greater mortality in expatriates. Future studies will determine the role of hepatitis C and E. Typhoid fever shows an incidence rate of 0.3/1000 in foreigners on the Indian subcontinent, and in many parts of North and West Africa, excluding Tunisia, in other parts of the third world it is tenfold lower. In poliomyelitis, tetanus, diphtheria, cholera, rabies, and Japanese encephalitis, the incidence rate is greater than or equal to 0.002/1000. Author

**N93-11289#** Camerino Univ. (Italy). Dept. of Hygiene.

**VACCINATION AGAINST HEPATITIS B: THE ITALIAN STRATEGY**

A. R. ZANETTI, J. GRAPPASONNI, E. TANZI (Milan Univ., Italy), and L. ROMANO (Milan Univ., Italy) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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Viral hepatitis type B is a major worldwide public health problem. Infection with the hepatitis B virus (HBV) may progress to chronic liver disease including chronic active hepatitis, cirrhosis, and hepatocellular carcinoma. Moreover, it has been estimated that between 200 and 300 million individuals in the world are chronic carriers of HBV. The availability of safe and effective vaccines allows the establishment of immunization programs aimed at the elimination of hepatitis B and the reduction of morbidity and mortality due to its sequelae. The topics covered include the following: (1) vaccines against hepatitis type B; (2) safety, immunogenicity, and efficacy of hepatitis B vaccines; (3) strategies for control of hepatitis B by immunization; and (4) hepatitis B vaccination in Italy. Author

**N93-11290#** World Health Organization, Geneva (Switzerland). Global Programme on AIDS.

**HIV INFECTION IN THE NINETIES**

LARS O. KALLINGS *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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By the year 2000, a cumulative global total of 30 to 40 million men, women, and children are projected to have been infected with HIV. This will present a 3 to 4 times increase of the present total. Currently, it is estimated that about 5000 persons are newly infected daily. Worldwide, the predominant and increasing mode for transmission is by heterosexual intercourse. Therefore, the number of infected women will equal that of men. Consequently, more infants will be infected by their mothers and more infants will be orphaned as their parents die of AIDS. By the end of the 1990's, over one million adults, most of them in developing countries. Although the majority of HIV infections are currently occurring in Sub-Saharan Africa, the annual number of HIV infections in Asia is projected to exceed that in Africa during the 1990's. Also in industrialized countries, the proportion of heterosexual transmission is increasing, and AIDS is becoming

one of the predominant causes of death in young men and women. In spite of promising scientific progress, vaccines and therapeutic drugs are not expected to have any major impact on the global development of the pandemic during the 1990's. The World Health Organization (WHO) is promoting behavioral changes, condom use, and control of other sexually transmitted diseases as the most important preventive measures. Insight into the dynamics of the HIV/AIDS pandemic and into the growing understanding of the main factors which are fuelling the continued and increasing HIV transmission is given. A short survey of the epidemiological background, the current trends, and the forecasts of the directions of the epidemic during the next decade are presented. Author

**N93-11291#** Walter Reed Army Medical Center, Washington, DC. Div. of Retrovirology.

### **AIDS/HIV IN THE US MILITARY**

DONALD S. BURKE and EDMUND C. TRAMONT *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 6 p Apr. 1992

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HIV infection (AIDS) burst upon the scene a decade ago. Because it is a sexually transmitted disease that infects blood and kills its victim, it is military relevant and will impact on all aspects of the military. The USAMRDC as Lead Agent for Infectious Disease Research in the DoD has developed a comprehensive approach to address military concerns: surveillance of infection rates (intelligence) around the world and in the military; behavioral research to develop more effective means of education to change behavior; and biological research to develop a quick and easy field test, and a vaccine or drug to prevent the disease from occurring despite exposure. Its success will influence the success of the Army in the future. Author

**N93-11292#** Aerospace Medical Research Labs., Brooks AFB, TX. Epidemiologic Research Div.

### **ESTIMATES OF HUMAN IMMUNODEFICIENCY VIRUS (HIV) INCIDENCE AND TRENDS IN THE US AIR FORCE**

RONALD D. WARNER, ROBERT E. MATHIS, MARY E. WESTON, LARRY R. BIGBEE (Defense Manpower Data Center, Monterey, CA.), CRAIG W. HENDRIX (Air Force Medical Center, Lackland AFB, TX.), and DANIEL R. LUCEY (Air Force Medical Center, Lackland AFB, TX.) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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Between early 1986 and February 1991, over 700,000 United States Air Force (USAF) active duty personnel had been screened for antibodies to the Human Immunodeficiency Virus (HIV). All HIV-infected patients are evaluated at Wilford Hall USAF Medical Center, and staged using the Walter Reed scheme. Two total-force screenings were conducted prior to October 1990. The USAF case registry is maintained by the Epidemiological Research Division. Computer support for incidence calculations is provided by the Defense Manpower Data Center. During the first screening (February 1986-September 1988), 721 HIV-positive personnel were detected from a USAF population of approximately 607,000. The estimated seroprevalence was 1.2/1000. From the second screening 206 positive individuals were detected among approximately 571,000 personnel. As of January 1991, among the total 942 HIV-positives, only 29 were female. Three hundred and fifty-one (37.3 percent) remained on active duty in the US; 296 (31.5 percent) were on temporary disability retirement lists; 193 (20.5 percent) had separated or retired; and 101 (10.7 percent) had died. From June 1987 through June 1990, the estimated incidence of HIV infection in USAF personnel declined from 0.19 to 0.17/1000 person-years. The rate for males in June 1987 was estimated at 0.21/1000 person years. In all, the highest rate was among black males. In October 1985, the US Department of Defense (DOD) mandated that all applicants for military service be tested for evidence of antibodies to the human immunodeficiency virus (HIV). This testing continues, and if they test-positive, applicants are denied entry. Testing of those already in the US military services began soon afterward. Between early

1986 and February 1991, over 700,000 active-duty US Air Force (USAF) personnel were tested for the presence of HIV antibodies. In addition to two total-force (USAF, USAF Reserves, and Air National Guard) screenings prior to October 1990, USAF personnel have been tested in conjunction with: evaluation and treatment for other sexually transmitted diseases, routine and periodic physical examinations, enrollment in drug or alcohol rehabilitation programs, orders to permanent overseas assignments, and clinically-indicated medical reasons. The 1987-1990 HIV incidence estimates are discussed in a relatively young, mobile male population by age, ethnicity/race, sex, and occupational category at time of positive HIV antibody test. Author

**N93-11293#** Rome Univ. (Italy). Dept. of Allergy and Clinical Immunology.

### **SILENT HIV INFECTION**

FERNANDO AIUTI, FABRIZIO ENSOLI, VALERIA FIORELLI, IVANO MEZZAROMA, ELENA PINTER, EMMA GUERRA, and GIUSEPPE LUZI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992

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The period of latency between infection by the human immunodeficiency virus type-1 (HIV-1) and the production of specific antibodies to viral antigens may be prolonged and, occasionally, may last for years. This condition of seronegative infection could represent a serious risk of viral transmission from subjects who are unaware of their status. However, whether these individuals are actually infectious, especially through body fluids, has not been clarified. We have performed a prospective study in 65 high risk individuals seronegative for HIV-1 antibodies for a prolonged period of time. Twelve of them (18 percent) were shown to be carriers of HIV-1 proviral sequences by the polymerase chain reaction (PCR). The virus was isolated from nitrogen-stimulated peripheral blood lymphocytes (PBMC) in five out of ten subjects tested since the first positive PCR. In two of them, virus could also be isolated from cell free plasma, subsequently they remained seronegative during 10 months of follow-up. These data indicate that delayed seroconversions may be associated with productive infection, suggesting that mechanism(s) other than viral latency may be responsible for the absence of antibody responses to HIV-1 proteins. Furthermore our findings suggest that prolonged seronegative individuals can transmit HIV-infection through their body fluids. Author

**N93-11294#** Istituto Superiore di Sanita, Rome (Italy). Lab. of Virology.

### **HIV VARIABILITY AND PERSPECTIVES OF A VACCINE**

P. VERANI, S. BUTTO, B. TADDEO, M. FEDERICO, and G. B. ROSSI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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Since Human Immunodeficiency Virus (HIV) was identified as the causative agent of Acquired Immunodeficiency Syndrome (AIDS) the pressing challenge that researchers are facing is the development of a vaccine against this disease. Although progress has been made in the study of the biology of HIV faster than for any other virus, the development of an effective vaccine has been slowed by the peculiar features of HIV. The difficulties standing before a rationale approach to vaccine design are: (1) the ability of the virus to rapidly change its genome sequence; (2) its spreading from cell to cell; (3) its ability to establish latent infection integrating its genome into that of the target cell without expressing any viral genes and, thus remaining hidden inside the infected cell; and (4) its insidious attack on the immune system upon which a vaccine depends in order to be effective. The design of a rationale approach to a vaccine is discussed. Author

**N93-11295#** Aerospace Medical Research Labs., Brooks AFB, TX. Epidemiologic Research Div.

### **IMMUNOLOGICAL PARAMETERS IN CURRENT AND FORMER US AIR FORCE PERSONNEL**

WILLIAM H. WOLFE, JUDSON C. MINER, and JOEL E.

MICHALEK *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992  
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Major advancements have been made in the laboratory assessment of the immune system over the past decade. There has been a proliferation of sophisticated techniques to measure the number and functional capacity of subsets of lymphocytes and other cellular elements of the immune system. Unfortunately, the space of this technology has made it difficult for many practicing physicians to develop and maintain an understanding of these new tests. Additionally, appropriate reference values for these tests in 'normal' populations are unclear and little has been done to assess the effects of factors such as age, race, and lifestyle on these measures of immunity. Laboratory assays are available to assess both the counts of the various cellular elements of immunity in the peripheral blood as well as the functional capacity of many of these cells. Tests of delayed cutaneous hypersensitivity are based on techniques used in allergy testing and tuberculosis control. After antigens such as Trichophyton or Candida are injected intradermally, the skin's reactivity correlates with the recall sensitivity of the T cells to each antigen used. Counts of total T lymphocytes (CD2 cells) and B lymphocytes (CD20 cells) are decreased in immune deficiency conditions and are elevated with lymphoproliferative diseases. The helper/inducer T lymphocytes (CD4 cells) are commonly decreased in progressive HIV infection and are increased in autoimmune disorders. The suppressor T cells (CD8) are increased in some viral infections and immunodeficiency states. The CD4/CD8 ratio is a commonly used measure of immune system capability. Tests of activated T lymphocytes (CD25 cells) assess the presence of stimulated T lymphocytes. Unstimulated T cells do not react to this test. This is a useful test in identifying the presence of lymphoproliferative disorders. Count of total lymphocytes is also made. Tests of the functional status of the cellular components of the immune system assess the response of the cells in the peripheral blood to stimulation with various mitogens such as phytohemagglutinin. These tests measure the cells' capability to become activated by external stimuli. The natural killer cell assay measures the body's lytic response to foreign tissue cells both before and after stimulation with interleukin. This response is decreased with impaired natural immunity. Standard quantitative measurements of immune globulins (IgA, IgG, and IgM) are also useful in the assessment of immune functions. They measure the ability of specific B lymphocytes to secrete specific classes of antibody. A useful approach to the categorization of several of the quantitative and functional tests of immunity is shown. The tests provide a comprehensive assessment. As part of a comprehensive epidemiologic study of current and former Air Force personnel, an extensive assessment of the immune system was conducted by a single immunology reference laboratory using stringent quality control standards. All of the tests described above were used in this study. The demographic characteristics of these study subjects are displayed. All of the subjects were middle-aged males, most of whom did not currently smoke tobacco. Nearly 80 percent of them currently drink alcoholic beverages. Author

**N93-11296#** Air Force Medical Center, Lackland AFB, TX. Dept. of Infectious Diseases.

**EARLY MARKERS OF HIV INFECTION AND SUBCLINICAL DISEASE PROGRESSION**

M. J. DOLAN, D. R. LUCEY, C. W. HENDRIX, G. P. MELCHER, G. A. SPENCER, and R. N. BOSWELL *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 6 p Apr. 1992

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Human Immunodeficiency Virus (HIV) infection in U.S. Air Force personnel between 1985 and 1989 was examined through a mandatory serologic survey, and through annual examination of infected patients. CD4+ cell counts were determined by flow cytometry; Beta 2 microglobulin and neopterin were measured by immunoassay. During this period, 933 cases were found, of which 161 were documented seroconversions, giving an incidence rate of 15.6/100,000 person-years. For patients with greater than 400

CD4 cells/microliter, the rate of initial occurrence of opportunistic infection was 1 percent and 4 percent at 1 and 2 years, respectively. HIV infected persons with less than 400 CD4+ cell/microliter, in contrast, had rates of 21 percent at 1 year and 36 percent at 2 years. In a cross-sectional study, Beta 2 microglobulin concentration was shown to increase in both the serum and spinal fluid of patients infected with HIV as their blood CD4 numbers declined. Neopterin levels in serum and spinal fluid showed a similar trend, with significantly lower neopterin concentrations in the group that had greater than 1000 CD4+ T cells compared to the 0-600 CD4+ cell group. Longitudinal studies included correlation of HIV p24 antigen with CD4 counts over a one year period. The p24 antigen-positive group has a 21 percent decline in CD4+ T cells, while the antigen negative group has a 14 percent decline. Specific helper T-cell subsets were also examined over a 6 month period. A significant decline was seen in the CD4+/DC29+, CD4+/DC45R+, and overall CD4+ subsets which were not seen in AZT treated patients. A significant increase in the CD4+/CD29+ memory T-cell subset, which is responsible for response to recall antigens and is capable of Upsilon interferon secretion, was noted in the AZT-treated group. Author

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**ANALYSIS OF DISEASE PROGRESSION FROM CLINICAL OBSERVATIONS OF US AIR FORCE ACTIVE DUTY MEMBERS INFECTED WITH THE HUMAN IMMUNODEFICIENCY VIRUS: DISTRIBUTION OF AIDS SURVIVAL TIME FROM INTERVAL CENSORED OBSERVATIONS**

JORGE ARAGON, MARY WESTON (Aerospace Medical Research Labs., Brooks AFB, TX.), and RONALD WARNER (Aerospace Medical Research Labs., Brooks AFB, TX.) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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A nonparametric estimator of the Acquired Immunodeficiency Syndrome (AIDS) survival time (after developing AIDS) is computed for the AIDS data set from the US Air Force (USAF). Survival times are unobservable. They are censored by the screening mechanism. The Armstrong Laboratory's Epidemiologic Research Division maintains data on over 940 active duty US Air Force (USAF) individuals who tested positive for Human Immunodeficiency Virus (HIV) antibodies. Many have been clinically evaluated six times since 1986. The HIV-positive individual is classified in seven stages of the disease complex as time progresses. Exact times of transition from one stage to the next are unknown. It is known that transition occurred between two consecutive evaluations. The aim of this study is to analyze distributions of the times that individuals spend in each stage of the HIV disease complex. We discuss methods used to obtain nonparametric estimators of the distributions of times that individuals spend in stage 6. Finally, we hope to model the median time spent in each stage of the disease. This, along with incidence and separation data, will allow us to predict the impact of HIV disease on USAF individual and medical care systems. Author

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**RELATING COGNITIVE FUNCTION TO MILITARY AVIATOR PERFORMANCE IN EARLY HIV INFECTION**

R. L. MAPOU, JAMES R. RUNDELL (Uniformed Services Univ. of the Health Sciences, Bethesda, MD.), G. G. KAY (Georgetown Univ., Washington, DC.), and E. C. TRAMONT (Walter Reed Army Medical Center, Washington, DC.) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 6 p Apr. 1992

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There has been controversy about whether cognitive changes occur in early human immunodeficiency virus (HIV) disease. In those studies reporting cognitive changes, findings are typically subclinical, and their relationship to daily and/or occupational functioning has not been addressed. The potential effects of changes may vary as a function of occupational demands. This is germane to military performance, where occupational demands

cover a wide spectrum of complexity. In particular, such effects are important to consider in the many cognitively-demanding specialties associated aviation. Ways in which possible HIV-related military performance decrements in aviators may be measured empirically are explored. First, studies from Walter Reed Army Medical Center (WRAMC), which have shown cognitive changes in early HIV disease, are described. This is followed by a summary of presentations and discussions at a November, 1990 conference, entitled, HIV and Military Performance: Assessment Methodologies, held at WRAMC. The third section describes a program of research, which is developing measures to detect cognitive difficulties in civilian aviators. The application of measures from this research to research on HIV is discussed. Finally, a research program being developed to examine the possible impact of HIV-related cognitive changes on military aviator performance is presented. Author

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**NEUROPSYCHIATRIC MORBIDITY IN EARLY HIV DISEASE: IMPLICATIONS FOR MILITARY OCCUPATIONAL FUNCTION**  
 GEORGE R. BROWN, JAMES R. RUNDELL (Walter Reed Army Medical Center, Washington, DC.), SUSAN E. MCMANIS (Air Force Medical Center, Lackland AFB, TX.), SARAH N. KENDALL, and RICHARD A. JENKINS (Walter Reed Army Medical Center, Washington, DC.) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 14 p Apr. 1992

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The Military Medical Consortium for Applied Retroviral Research's (MMCARR) Behavioral Medicine Human Immunodeficiency Virus (HIV) Research component is conducting a tri-service, comprehensive, and longitudinal research study in military HIV-infected personnel at all stages of infection. Identification of neuropsychiatric and psychosocial outcomes and their determinants will help the military minimize the impact of the HIV epidemic on military readiness and function. Neuropsychiatric and psychosocial findings are among the most common complications seen in early HIV Disease and among the most likely to have an adverse impact on military readiness and function. The study has demonstrated that the average HIV-infected service-person experiences at least transient military occupational difficulty following notification of HIV status. More than 15 percent at any given time have levels of clinical or subclinical anxiety or depression that are referable for mental health intervention. Ten percent of study subjects have a current major mood disorder and 5 percent have a psychoactive substance use disorder. Finally, 17 percent of study subjects have experienced serious suicidal ideation or behaviors at least once since notification of seropositivity. Fortunately, however, data also indicate at least partial effectiveness of current primary, secondary, and tertiary preventive efforts. Only about 1 percent of Air Force HIV-infected persons are discharged for psychiatric reasons prior to eventual medical discharge. Further, a large majority of active-duty patients demonstrate solid military occupational and social performance. Though military HIV neurobehavioral research is still in progress, preliminary data identify social support and pre-HIV psychiatric predisposition as important factors associated with current neuropsychiatric status. Author

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 Div. of Communicable Disease.

**COMMUNICABLE DISEASES: A MAJOR BURDEN OF MORBIDITY AND MORTALITY**

G. TORRIGIANI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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Communicable diseases, complicated by malnutrition and other adverse socioeconomic factors, continue in the present decade to contribute greatly to the unacceptably high levels of morbidity, mortality, and disability, particularly in the under-five age group, in all developing countries. It is estimated that five million deaths occur per year from diseases which can be prevented by vaccines available today, and that another five million people are being crippled, blinded, or mentally retarded as a result of the same

diseases. Some of the most important communicable diseases, with their mortality rate, are reported. Some of the topics discussed include sexually transmitted diseases, disease control, chemotherapy, and environment management. Author

**N93-11301#** Aerospace Medical Research Labs., Brooks AFB, TX. Epidemiology Div.

**SUSCEPTIBILITY IN USAF RECRUITS TO VACCINE PREVENTABLE DISEASES**

WILLIAM F. CLARDY *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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Because of increasing incidence of mumps in a cohort of under immunized young adults and the concern about the impact of this disease on the USAF recruit population, two studies were undertaken. These studies took a retrospective look at the following: mumps in the active duty population; a cost analysis of immunizing all or only susceptible individuals; the actual antibody response in a group of two hundred and seventy-six recruits in basic training; the demographic patterns of susceptibility; and the types of previous immunization documentation. The conclusions were that the numbers of new mumps cases per year did not justify immunizing all recruits or screening for mumps antibodies. Author

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**ABSENCE OF PROTECTIVE IMMUNITY AGAINST DIPHTHERIA IN A LARGE PROPORTION OF YOUNG ADULTS**

R. RAPPUOLI, A. PODDA, F. GIOVANNONI, L. NENCIONI, M. PERAGALLO, and P. FRANCOLINI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 2 p Apr. 1992

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The schedule of vaccination which is recommended worldwide for diphtheria, tetanus, and other diseases provides good immunity during childhood. However, little attention has been paid to keep an effective immunity in adults. We have collected sera from 334 recruits of the Italian Army and tested them for the presence of protective immunity against diphtheria and tetanus. In vivo neutralization assays were performed on rabbits and mice and the values below 1/100 IU/ml were considered negative. Of the recruits, 22.9 percent were negative for diphtheria, while only 5.3 percent of them did not have protective immunity against tetanus. This finding shows that a large proportion of the Italian young adults are susceptible to diphtheria, and this could be dangerous if they travel to sites where this disease is still endemic, or if they come into contact with people coming from such areas. A booster vaccination of young adults against diphtheria should enter in the common practice in order to avoid this risk. In order to reduce the side effects which are often associated with diphtheria vaccination in adults, we have developed a vaccine which contains a highly purified nontoxic mutant of diphtheria toxin. This vaccine is combined with tetanus toxoid and can be routinely used as a booster in adults. Author

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**DRAMATIC REDUCTION OF MENINGOCOCCAL MENINGITIS AMONG MILITARY RECRUITS IN ITALY AFTER INTRODUCTION OF SPECIFIC VACCINATION**

R. BISELLI, A. FATTOROSI, P. M. MATRICARDI, R. NISINI, T. STROFFOLINI, and R. DAMELIO (Istituto Superiore di Sanita, Rome, Italy) *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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Meningococcal meningitis still represents a serious infectious disease with a mortality rate that can be as high as 10 percent even in developed countries. Military recruits are generally a high risk group for meningococcal disease, with a reported incidence of 4 to 10 times greater than that of the general population. In Italy the results of the National Meningitis Surveillance Program

showed a high attack rate of the disease among recruits in 1985 as well as in 1986, with 92 and 95 percent of the cases, respectively, caused by serogroup C and thus preventable. These findings constituted the motivating factors leading to the authorities' decision to make vaccination against meningococcal disease mandatory for recruits starting from January 1987. After almost 5 years from the introduction of meningococcal vaccination, we present a summary of the epidemiological and immunological effects of the vaccination. From the epidemiological point of view we have observed a dramatic reduction of the prevalence of the disease. In 1987, that is the year in which we had 150,000 unvaccinated and 150,000 vaccinated recruits, the protective efficacy was 91.2 percent. From the immunological point of view, vaccination is highly effective, as seroconversion against polysaccharide (PS) A and C is 84 and 91 percent, respectively. The spectrotypic analysis of the sera before and after vaccination shows that the type of response is mainly oligoclonal, like the majority of the responses to PS's, and the antibodies induced by sole PS are not qualitatively different from the antibodies induced by natural immunization. In addition, the efficacy is not modified by environmental factors like hypoxia, as demonstrated during permanence at 16,174 feet for 20 days. In conclusion, the anti-meningococcal PSA and PSC vaccine can be looked at as a very safe and effective method in controlling the spread of the disease in military recruits since: (1) its efficacy is very high, considering approximately 90 percent of the subjects develop a protective response; (2) it is safe; and (3) it has proven to provide satisfactory immunological response even under unfavorable conditions, like hypobaric hypoxia. Author

**N93-11304#** Hopital d'Instruction des Armees, Paris (France).  
**IMMUNIZATION OF PERSONNEL TRAVELING TO A DESTINATION IN TROPICAL COUNTRIES: FRENCH POSITION [IMMUNISATION DU PERSONNEL NAVIGANT A DESTINATION DES PAYS TROPICAUX: POSITION FRANCAISE]**  
 F. DIDELOT, C. P. GIUDICELLI, J. P. GOUBAT, J. P. BURLATON, G. NEDELEC, and A. SEIGNEURIC *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992 *In* FRENCH  
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The possibility of infectious risks incurred during sojourns in tropical zones justifies preliminary prevention. Aside from obligatory measures, it is important to discern recommended and other desirable actions. The obligatory measures essentially concern antimalarial vaccination for those personnel whose travel brings them into the intertropical zones of Africa and America. The partial and limited efficacy of the anticholera vaccination has practically justified its abandonment. The recommended measures include vaccinations against tetanus, diphtheria, poliomyelitis, (BCG) and typhoid. Obligatory in France for all children, except for the latter, these vaccinations must be replaced by boosters for all adults. Well tolerated, the new vaccine against typhoid (polyosidic, purified Vi antigen) merits being systematically employed. Other immunizations are desirable: vaccinations against meningococcal meningitis (serogroups A and C) in the young adult and against viral hepatitis B and injection of gammaglobulins for the prevention of hepatitis A virus. Finally, the high tolerance for anti-rabies vaccine leads to counseling the generalization of its use, due to the possible risk of a supply default at an opportune moment. Contradictions are restated and a vaccinal calendar is proposed. Aside from oral forms of vaccines against cholera and against typhoid, future perspectives concern vaccines against viral hepatitis A and against Japanese encephalitis. These are directed against the major risks, those such as malaria and AIDS unfortunately appear, even today, to be aleatory. Author

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**CLINICAL AND IMMUNOLOGICAL RESPONSE TO VACCINATION WITH PARENTERAL OR ORAL VACCINES IN TWO GROUPS OF 30 RECRUITS**  
 ROBERTO NISINI, ROBERTO BISELLI, PAOLO M. MATRICARDI, ANDREA FATTOROSI, and RAFFAELE DAMELIO *In* AGARD,

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The clinical and immunological responses to typhoid vaccination with parenteral and oral vaccines in two groups of 30 adult male subjects were studied. Specific anti-Salmonella typhi cell-mediated immunity and total or specific anti-lipoplysaccharide fecal immunoglobulin (Ig) A titers in vaccinated subjects were monitored. Cellular antibacterial activity was significantly increased only in orally vaccinated subjects. Serum arming activity and inhibition experiments suggested an IgA-dependent cellular cytotoxicity in those orally vaccinated. In these subjects, a total and anti-lipoplysaccharide fecal IgA increase was observed lasting up to 8 months after completion of vaccination schedule. In parenteral vaccinated subjects, an early onset transitory increase of IgM rheumatoid factor was observed. Oral vaccine was well tolerated and free of side effects, whereas 65 percent of parenterally vaccinated subjects reported side effects such as fever, headache, malaise, and local tenderness in the injection site. Author

**N93-11306#** Georgetown Univ., Washington, DC. Dept. of Pediatrics.

**STUDIES OF SAFETY, INFECTIVITY, AND IMMUNOGENICITY OF A NEW TEMPERATURE SENSITIVE (TS) 51-1 STRAIN OF S. TYPHI AS A NEW LIVE ORAL TYPHOID FEVER VACCINE CANDIDATE**

J. A. BELLANTI, B. J. ZELIGS, S. VETRO, Y.-H. PUNG, S. LUCCIOLI, M. J. MALAVASIC, A. M. HOOKE, T. R. UBERTINI, R. VANNI, and L. NENCIONI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 6 p Apr. 1992 Prepared in cooperation with Sclavo S.p.A., Siena, Italy  
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This report describes the results of a phase 1 study evaluating the safety, infectivity, and immunogenicity of a new live oral S. typhi ts 51-1 typhoid fever vaccine in the human. Three normal males subjects ranging in age from 20 to 40 years received 3 oral doses of S. typhi ts 51-1, each dose containing 10(exp 9) organisms. Prior to and following immunization each subject was carefully monitored by clinical and laboratory parameters over a two week period during which serial specimens of blood and stool were analyzed for the presence of the organism. Blood specimens were also obtained for the determination of serum antibody and cell-mediated immune responses and stool filtrates were analyzed for the development of coproantibody. The results of these studies indicate that: (1) the vaccine is well tolerated with no clinical or laboratory evidence of adverse reactions; (2) ts 51-1 was detected in only one stool specimen from one volunteer; the organism recovered displayed characteristics of the ts 51-1 vaccine strain; (3) although no significant humoral or cell-mediated lymphocytotoxic immune responses were detected in the blood, coproantibody was detected in stool specimens from all of the 3 immunized subjects and IgA-armed ADCC activity was detected in 2 of 3 subjects. These studies indicate that S. typhi ts 51-1 may be a suitable strain for the development of an improved oral typhoid fever vaccine. Studies are in progress to determine optimal methods of vaccine delivery preparatory to larger phase 2 studies of efficacy. Author

**N93-11307#** Zurich Univ. (Switzerland). Div. of Epidemiology and Prevention of Communicable Diseases.

**RECENT LESSONS ON THE SAFETY AND EFFECTIVENESS OF MALARIA CHEMOPROPHYLAXIS IN A NON-IMMUNE POPULATION**

R. STEFFEN *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992  
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To assess adverse events (AE) and the effectiveness of malaria chemoprophylaxis in short term travelers to East Africa, two similar follow-up studies were conducted, the second of which is on-going. Pooled data of both studies are presented, in which all passengers returning from Kenya by British, German, or Swiss charter flights were distributed a questionnaire aboard and a second one three

months later. Any report of documented malaria or of a hospitalization for adverse events was investigated with the physician. So far, 98,650 travelers have completed at least one questionnaire. AE were reported by 22.3 percent of 30,871 having used mefloquine (MQ), by 19.9 percent of 5,342 having used chloroquine (CQ) 300 mg base/week, by 22.2 percent of 7,930 having used Q 600 mg base/week, by 29.4 percent of 1,114 having used amodiaquine (AQ), by 1.63 percent of 24,532 having used sulfadoxine/pyrimethamine (SP), and by 26.1 percent of 6,851 having used CQ plus proguanil (PG). Dizziness was more frequent with MQ than with other agents. Twenty hospitalizations were attributed to AE: seven occurred after prophylaxis with CQ (including 2 cases of psychosis), four were attributed to SP (2 fatal), and five to AC (2 fatal). Just two were attributed to MQ: one each for psychosis and one for seizures in a known epileptic, one additional case with seizures was not hospitalized. Prophylactic effectiveness was 94 percent (95 percent C.I. 85-96) for MQ, 84 percent (77-90) for SP, 74 percent (48-88) for CQ+PG, and 30-54 percent for CQ in various dosages. In conclusion, mefloquine appears to be highly efficacious for malaria prophylaxis in areas with widely distributed chloroquine resistant *P. falciparum*. Tolerance seems to be comparable to the one of chloroquine; thus, the contra-indication of the use of mefloquine in pilots will have to be reconsidered. Author

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**USE OF NOVEL ADJUVANTS AND DELIVERY SYSTEMS TO IMPROVE THE HUMORAL AND CELLULAR IMMUNE RESPONSE TO MALARIA VACCINE CANDIDATE ANTIGENS**

D. M. GORDON *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992  
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The immune effector mechanisms responsible for the solid protection against malaria, as demonstrated by immunization with radiation attenuated sporozoites, are poorly understood. An effective malaria vaccine must induce a well orchestrated combination of humoral and cellular immune responses directed against critical parasite antigens/epitopes expressed during different stages of the parasites complicated life-cycle. Currently, licensed human vaccine adjuvants, such as alum, may improve antibody production but are poor stimulators of cellular effector mechanisms, while potent cellular stimulants such as Freund's adjuvant are too reactogenic for human use. Over the last five years, we have systematically evaluated several methods of antigen presentation to include chemical conjugation to bacterial carrier proteins, emulsification in 'Freund's-like' preparations, and incorporation into liposomes. This work has resulted in the production of safe, potent vaccine delivery systems capable of targeting multiple antigenic determinants to the host's immune system. Further advances in malaria vaccine development now depends on the identification of appropriate parasite epitopes for inclusion in a multicomponent-multistage vaccine. Author

**N93-11309#** DOMPE S.p.A., L'Aquila (Italy). Biotechnology Dept.

**CYTOKINES AS VACCINE ADJUVANTS: INTERLEUKIN 1 AND ITS SYNTHETIC PEPTIDE 163-171**

ALDO TAGLIABUE *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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The possibility of preventing infectious diseases by employing efficacious vaccine is rapidly growing as the consequence of the new technologies in recombinant DNA and protein chemistry. However, the increasing number of synthetic and recombinant antigens further stresses the importance of the role of appropriate adjuvants to ensure the maximal vaccine activity and the protection of all vaccines. Several approaches can be applied to develop safe and effective agents capable of enhancing specific immune responses which can then protect the host from the pathogen. Among others, the direct use as adjuvant of those cytokines which are induced in animals by the classical Freund adjuvants has

recently become a matter of investigation. In particular, interleukin 1 (IL-1) has been shown to possess adjuvant activity for a variety of infectious and tumor antigens. However, the numerous side effects associated to the proinflammatory action of IL-1 represent a serious disadvantage for its use as a vaccine adjuvant. Therefore, it was of great interest that the observation of a nonapeptide contained in the IL-1beta sequence (residues 163-171 corresponding to the sequence VQGEESNDK) is devoid of all the proinflammatory activities but maintains the immunostimulating activity of the whole IL-1beta. Thus, 163-171 peptide was successfully employed in animals to potentiate the specific immune response against T helper-dependent cellular antigens, T helper-independent polysaccharidic antigens and recombinant, as well as synthetic antigenic preparations derived from human pathogens. Furthermore, IL-1 and 163-171 peptide were successfully used in tumor vaccines in experimental systems. Therefore, it can be concluded that 163-171 peptide is potentially a good candidate as vaccine adjuvant for human use. Author

**N93-11310#** World Health Organization, Geneva (Switzerland). Microbiology and Immunology Support Services.

**FUTURE APPROACHES TO VACCINE DEVELOPMENT SINGLE-DOSE VACCINES USING CONTROLLED-RELEASE DELIVERY SYSTEMS**

M. T. AGUADO *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992  
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The development of new vaccines, both more efficacious and easier to deliver, has become an area of research that can certainly benefit from recent technical developments. In particular, the conversion of multiple-dose vaccines into single-dose vaccines may represent an important advance which should lead to improved vaccination coverage, as well as to a reduction in vaccination costs. Taking these considerations into account, one of the main goals of our program has become the development of a strategy to convert multiple dose vaccines to single-dose vaccines with the same or increased effectiveness. The initial priority of this project was to develop a single-dose tetanus vaccine, as one of the most urgent needs of the Expanded Program on Immunization to control neonatal tetanus. The use of controlled-release systems, already applied to deliver a whole array of drugs and hormones both in cattle and man, appears to be one way of accomplishing our goal. Among these systems, polymeric particles have been widely used for injectables. They can be classified into two main groups: the reservoir type, with material in solution in the cavity formed by a polymeric membrane; and the monolithic type, with materials evenly dispersed throughout the polymeric matrix. Indeed, the first type is usually known as microcapsules and the second as microspheres. Microspheres seems to be preferred to microcapsules because of the better control of drug or vaccine liberation. At present, the pre-clinical results obtained seem to point in the direction of the successful development of single-dose controlled-release vaccines. Author

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**EPIDEMIOLOGIC VIEW OF ALLERGIC DISEASES IN NORTH AMERICA: IMPLICATIONS FOR AEROSPACE MEDICINE**

J. A. BELLANTI *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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The allergic disorders comprise a heterogeneous group of diseases which involve the respiratory tract (e.g., allergic rhinitis and asthma), the skin (e.g., atopic eczema), and the gastrointestinal tract (e.g., allergic gastroenteritis, food allergy) and which afflict 50 million Americans. The respiratory allergic diseases affect major segments of the population (15 to 17 percent) who may be recruited as aircraft personnel; therefore, these diseases pose particular risk to flying safety or personnel either directly, or indirectly as a consequence of their disease or of the adverse effects of medications now used in the treatment of these disorders. Moreover, recent evidence is now accumulating to suggest that other environmental factors encountered in aerospace operations,

e.g., gravity, oxygen, and stress, may also contribute to the immunologic responses involved in and responsible for clinical manifestations of these allergic disorders. A thorough knowledge of these allergic diseases and reactions associated with therapy are, therefore, essential for proper screening of personnel prior to entry into the aerospace field. Moreover, principles of allergic therapy should be applied to existing trained personnel and combined with a knowledge of careful use of medications which are least likely to be associated with performance decrement. The availability of new medications which have minimal adverse effects, e.g., non-sedating antihistaminic drugs, are addressing some of the problems associated with these issues. Author

**N93-11312#** Divisione Aerea Studi Ricerche e Sperimentazioni, Pratica di Mare (Italy).

**THE SCREENING OF INHALANT ALLERGIC DISEASES IN THE SELECTION OF CANDIDATES FOR AIRCRAFT PILOTING**

P. M. MATRICARDI, R. NISINI, R. BISELLI, L. URBANI, C. DEANGELIS, G. PETRELLI, and R. DAMELIO *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 5 p Apr. 1992

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The validity of Phadiatop CAP as a tool in the mass screening for inhalant allergies was investigated. Two-hundred and seventy of 1815 Italian recruits were classified as allergics to inhalant allergens on the basis of history, physical examination, SPT for inhalants, and/or RAST for the seven most common aeroallergens in Italy. Phadiatop was positive in six-hundred and twenty-three (34.3 percent) subjects: in 265/270 allergics and in 357 subjects which had never experienced allergic symptoms; the vast majority of these subjects were also positive to STP and/or RAST. The level of Phadiatop reactivity was lower in this group with respect to the allergic one. In a subgroup of 98 subjects, bronchial hyperresponsiveness was also examined. A very high percentage (85 percent) of the subjects with bronchial hyperresponsiveness were also positive to Phadiatop, suggesting that atopy is one of the major etiologic factors of bronchial hyperreactivity in our population sample. We conclude that Phadiatop CAP is extremely useful in the screening of inhalant allergies in candidates to aircraft piloting. Author

**N93-11313#** Red Cross Hospital, The Hague (Netherlands) Dept. of Respiratory Medicine.

**PHADIATOP: A SCREENING TEST FOR INHALANT ALLERGY**

A. M. J. WEVER *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

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The Phadiatop test, a new *in vitro* test for inhalant allergy, was evaluated in relation to a panel of seven RAST tests with the common inhalant allergens in the Netherlands, and in comparison with the PRIST for total immunoglobulin E (IgE) determinations, in two populations: one in which the prevalence of inhalant allergy was expected to be high and one in which it was expected to be low. The Phadiatop was classified positive or negative according to percentage binding, total IgE was considered elevated at values greater than or equal to 200, greater than or equal to 150, and greater than or equal to 100 kU/l at ages 12-14, 15-16, and 17 years and over respectively. The RAST panel as reference was considered positive when at least on RAST result was class 2 or more. From the predictive values (which depend on the prevalence of the disease in the population) and the accuracies of the Phadiatop and the PRIST for the RAST, it can be concluded that the Phadiatop is a highly efficient test, much more so that the PRIST, in correctly classifying atopic and non-atopic subjects as judged by the reference RAST panel. Author

**N93-11314#** Navy Hospital, La Spezia (Italy).

**IN VIVO AND IN VITRO DIAGNOSIS OF ALLERGIC RESPIRATORY DISEASE DURING SCREENING PROCEDURES IN THE ITALIAN NAVY: COMPARATIVE EVALUATION OF A RECENT QUANTITATIVE AUTOMATIZED ENZYME IMMUNOASSAY METHOD TO DOSE SPECIFIC IGE**

G. ANZALONE, M. DELTRECCO, A. VIZZACCARO, and A. CORSICO *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 7 p Apr. 1992  
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The observation of a large number of young allergic patients gave us the possibility to acquire crucial information on the epidemiology, the aetiology, and the pathogenesis of respiratory allergies and particularly that of bronchial asthma. The diagnostic protocol used accomplished in a satisfactory way the proposed tasks to screen allergic conscripts and to clinically study already in service patients. Our evaluation of the recently introduced immunoassay ABBOTT-MATRIX confirmed its characteristics of specificity and reproducibility. It also demonstrated to be an easy to use 'in vitro' system with very poor requirements of intervention by the operator. We emphasize the need to routinely introduce 'in vitro' research of allergies for the preliminary screening of the candidates to the Military Academies, the schools for P. Officers, and to special categories with an expensive training and high risk, like pilots or divers. Author

**N93-11315#** Defence and Civil Inst. of Environmental Medicine, North York (Ontario). Central Medical Board.

**ASTHMA IN AIRCREW: ASSESSMENT, TREATMENT AND DISPOSITION**

GARY W. GRAY *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 4 p Apr. 1992

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Asthma represents a spectrum of increased airway reactivity from mildly increased responsiveness through to severe life-threatening bronchospasm. Rational recommendations for treatment and aeromedical disposition require a careful assessment of bronchial reactivity through correlation of the clinical findings with results of pulmonary function testing including an objective measure of airway reactivity. Airway challenge testing with methacholine allows a safe, objective assessment of airway reactivity. In the Canadian Forces, aircrew candidates with a history of wheezing, recurrent cough or bronchitis in childhood, or abnormal screening PFT's are further screened with an airway challenge test. Applicants with a PC20 less than 4 mg/ml are disqualified from pilot selection, and less than 2 mg/ml from other aircrew. Trained aircrew who develop wheezing are assessed with full pulmonary function testing including a methacholine challenge test. Those with objectively confirmed mild bronchial hyper-reactivity requiring no treatment or controlled by inhaled anti-inflammatory agents (corticosteroids, sodium cromoglycate, nedocromil sodium) are returned to flying in other than fast jets where even minor small airway instability may worsen ventilation-perfusion mismatch caused by +Gz. Author

**N93-11316#** Belgian Air Force, Brussels. Medical Centre of Aerospace Medicine.

**ALLERGY SCREENING AND FOLLOW-UP IN STUDENT PILOTS OF THE BELGIAN AIR FORCE (BAF)**

N. MORTIER, P. VANDENBOSCH, and C. VANCUTSEM *In* AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992

Copyright Avail: CASI HC A01/MF A03

The different methods used in the Medical Center of Aerospace Medicine, Brussels (Med C Aerospace) to detect allergy in pilot applicants, are discussed. During the period 1987 through 1989, the Total immunoglobuline E (IgE) levels were also determined at the start of pilot training. The aim was to assess if Total IgE could be used as an additional selection criterion. We conclude that it is not useful to determine the total IgE in the selection of pilot candidates. The existing investigations and examination methods are sufficient to detect allergy. Author

**N93-11317#** Hellenic Air Force General Hospital, Athens (Greece). Div. of Allergy.

**ALLERGIC AND NONALLERGIC RHINITIS IN GREEK PILOTS**  
C. GRIGOREAS, D. PAPPAS, A. AGELIDIS, and E. CHIMONAS  
*In* AGARD, Allergic, Immunological and Infectious Disease

Problems in Aerospace Medicine 3 p Apr. 1992  
 Copyright Avail: CASI HC A01/MF A03

In order to study the Allergic Rhinitis (AR) and Nonallergic Rhinitis (NAR) in Greek pilots, we examined 144 Greek male pilots, aged from 23 to 50 years, with symptoms of chronic rhinitis. The diagnosis was based on: (1) detailed history; (2) physical examination; (3) Skin Prick Tests (SPT) on common aeroallergens (positive SPT greater than 3 mm wheal); and (4) nasal secretions for assessment of eosinophilia (positive eosinophilia 20 percent eosinophils in nasal smears). Also, we measured serum total immunoglobulin E (IgE) (IV/ml) by the Paper-Radioimmunosorbent Test (PRIST) method and expressed as geometric mean value. We excluded patients suffering from chronic rhinitis (infections, mechanical-anatomic, drug-induced, sinusitis, and metabolic states) and bronchial asthma. Eighty-six patients (59.7 percent) had Seasonal Allergic Rhinitis (SAR), 30 patients (20.8 percent) had Perennial Allergic Rhinitis (PAR), 22 patients (15.3 percent) had Vasomotor Rhinitis (VR), and 6 patients (4.2 percent) had Nonallergic Rhinitis with Eosinophilia (NARE). One patient with PAR and 2 patients with NARE possessed nasal polyps. The frequency of major positive SPT in the SAR group was: (1) grasses (80.2 percent), (2) olive (69.7 percent), (3) parietaria (50 percent); and in the PAR group was: (1) House dust (100 percent), (2) mite *D. Farinae* (93.3 percent), (3) mite *H. D. Pteronyssinus* (90 percent). The levels of IgE among the four groups were 174.6 IV/ml in the VR group and 39.2 IV/ml in the NARE group. It is concluded, that in Greek pilots: (1) AR (SAR and PAR) was more frequent than NAR (VR and NARE); (2) the major aeroallergens responsible were different in patients with AR, since pollens predominated in the SAR group and house dust-mites in the PAR group; (3) patients with NARE had a high prevalence of nasal polyps; and (4) IgE levels were higher in patients with AR (SAR and PAR) than in patients with NAR (VR and NARE). Author

**N93-11318#** Hellenic Air Force General Hospital, Athens (Greece). Center of Aviation Medicine.  
**CORRELATION OF SERUM ALPHA SUB 1 ANTITRYPSIN WITH CIGARETTE SMOKING AND PULMONARY FUNCTION STATUS IN GREEK PILOTS, FOR A TEN YEAR PERIOD**  
 J. PALERMOS, K. KYRIAKOS, S. MICHALOPOULOU, CH. DASKALOPOULOS, and A. BITSAKTSIS /n AGARD, Allergic, Immunological and Infectious Disease Problems in Aerospace Medicine 3 p Apr. 1992  
 Copyright Avail: CASI HC A01/MF A03

Quantitative and mainly qualitative aberration of the alpha sub 1 Antitrypsin (a sub 1 AT) a major constituent of the human antielastase screen, is strictly associated with the development of lung emphysema. Certain factors like cigarette smoking and environmental pollution may contribute to that. In this study, we have correlated cigarette smoking with the serum a sub 1 AT concentration as well with the trend of predicted values of Forced Vital Capacity (FVC) and 1st Second Forced Expiratory Volume (FEV sub 1) over a ten year period. The study population consisted of 113 randomly selected male pilots, of the Greek Airforce, being in flight duties grouped into nonsmokers (n = 49, age x = 36.3) and effective smokers (n = 64, age x = 38.4) smoking for more than ten years. Serum a sub 1 AT level was 176 plus or minus 36 mg/dl (mean plus or minus SD) and 199 plus or minus 32 mg/dl for nonsmokers and smokers, respectively (p less than 0.001). Serum a sub 1 AT level for Greek male population was 190 plus or minus 35 mg/dl and the frequency of individuals with intermediate serum a sub 1 AT level was 2.7 percent. Recent and past (ten years ago recorded) FVC and FEV sub 1 predicted values were measured. This data suggest that: (1) cigarette smoking affects serum a sub 1 AT level; (2) intermediate serum a sub 1 AT level cannot be employed as a predictive criterion for flight personnel's pulmonary status; (3) ten years of cigarette smoking worsens the pulmonary function status significantly; and (4) extra physical exercise improves it. Author

**N93-11445#** Massachusetts General Hospital, Boston. Labs. of Photomedicine.  
**CENTER OF EXCELLENCE IN LASER MEDICINE**

J. A. PARRISH 1992 6 p  
 (Contract DE-FG02-91ER-61228)  
 (DE92-018760; DOE/ER-61228/3) Avail: CASI HC A02/MF A01  
 Achievements during the first six months of funding to prepare for a Center of Excellence in biomedical laser development include limited specific research projects within the Center's three broad interest areas, and program development to establish the Center and its activities. Progress in the three interest areas -- new medical laser systems development, optical diagnostics, and photosensitization, is reported. Feasibility studies and prototype development were emphasized, to enhance establishing a substantial Center through future support. Specific projects are an optimized laser-catheter system for reversal of vasospasm; optical detection of major skin burn depth and cancers using fluorescent drugs, and photosensitization of vascular tissues. In addition, an interdepartmental Laser Center was established at MGH to enhance collaborations and institutional commitment to the Center of Excellence. Competitive postdoctoral research fellowships, with provision for matching funds from other departments, have been announced. DOE

**N93-11561#** Rockefeller Univ., New York, NY.  
**CARBOXYALKYLATED HEMOGLOBIN AS A POTENTIAL BLOOD SUBSTITUTE Final Annual Report, 1 Sep. 1988 - 31 Oct. 1991**

JAMES M. MANNING 19 Nov. 1991 25 p  
 (Contract DAMD17-88-C-8169)  
 (AD-A252329) Avail: CASI HC A03/MF A01

The major focus has been on the preparation and full characterization of a new hemoglobin crosslinker - 2,5-diisothiocyanatobenzene sulfonic acid. Collaborative studies with investigators at the Letterman Army Institute of Research indicated that carboxymethylated hemoglobin was cleared from the circulation of rats with a half time of 42 minutes. The pseudo-first order plot indicates that a homogeneous population of molecules was present. In addition, there was no adverse pathological findings. The plasma retention time of the DIBS-crosslinked material that we prepared was also determined at Letterman to be 3-4 times longer than that of carboxymethylated hemoglobin. Cross-linking agents to produce derivatives of molecular weight 128,000 were also evaluated during this period. Other carboxyalkylating agents such as succinic semialdehyde in the presence of sodium cyanoborohydride have begun to be evaluated and compared with the carboxymethylated derivative. GRA

**N93-11841#** Harvard Univ., Cambridge, MA. Div. of Applied Sciences.

**THE EFFECTS OF LUMINANCE BOUNDARIES ON COLOR PERCEPTION Annual Report, 15 Mar. 1991 - 14 Mar. 1992**  
 R. E. KRONAUER, C. F. STROMEYER, III, A. CHAPARRO, and R. T. ESKEW, JR. 30 Apr. 1992 12 p  
 (Contract AF-AFOSR-0304-89)

(AD-A250705; AFOSR-92-0375TR) Avail: CASI HC A03/MF A01  
 Extensive measurements were made for detecting luminance and red-green flashes in the center of a bright yellow field. Thresholds, plotted in L- and M-cone contrast coordinates, indicate that chromatic flashes are more visible than luminance flashes even at very small size (2 inch diameter). Over a wide range of flash diameters and durations the chromatic flashes are detected with considerably higher efficiency (in units of cone contrast energy) than the most detectable luminance stimuli (small drifting gratings). The higher gain of the chromatic mechanisms has important physiological implications and is potentially useful in display technology. Detailed studies with luminance and chromatic stimuli suggest that the chromatic mechanisms have a constant spectral tuning, even for spots as small as 2 inches: the chromatic response is determined by a constant, equally weighted difference of L and M cone contrast. A suprathreshold luminance flash (a pedestal) facilitates detection of a coincident chromatic flash. Earlier studies suggested that the facilitation will grow strongly when the stimuli were decreased in size. In contrast, we find that facilitation is constant (2-3x) for stimuli from 2 inches to 2 deg diameter. GRA

**N93-11873#** Michigan Univ., Ann Arbor. Div. of Nuclear Medicine.

**NEW TECHNIQUES FOR POSITRON EMISSION TOMOGRAPHY IN THE STUDY OF HUMAN NEUROLOGICAL DISORDERS**

D. E. KUHL 1992 11 p

(Contract DE-FG02-87ER-60561)

(DE92-015353; DOE/ER-60561/6) Avail: CASI HC A03/MF A01

The general goals of the physics and kinetic modeling projects are to: (1) improve the quantitative information extractable from PET images, and (2) develop, implement and optimize tracer kinetic models for new PET neurotransmitter/receptor ligands aided by computer simulations. Work towards improving PET quantification has included projects evaluating: (1) iterative reconstruction algorithms using supplemental boundary information, (2) automated registration of dynamic PET emission and transmission data using sinogram edge detection, and (3) automated registration of multiple subjects to a common coordinate system, including the use of non-linear warping methods. Simulation routines have been developed providing more accurate representation of data generated from neurotransmitter/receptor studies. Routines consider data generated from complex compartmental models, high or low specific activity administrations, non-specific binding, pre- or post-injection of cold or competing ligands, temporal resolution of the data, and radiolabeled metabolites. Computer simulations and human PET studies have been performed to optimize kinetic models for four new neurotransmitter/receptor ligands, (C-11)TRB (muscarinic), (C-11)flumazenil (benzodiazepine), (F-18)GBR12909, (dopamine), and (C-11)NMPB (muscarinic). DOE

**N93-11893#** Naval Health Research Center, San Diego, CA.

**SMOKING STATUS AND BODY COMPOSITION, EXERCISE, DIETARY INTAKE, AND ALCOHOL/CAFFEINE CONSUMPTION Interim Report**

DORIS A. ABOOD and TERRY L. CONWAY Dec. 1991 34 p

(AD-A250648; NHRC-91-22) Avail: CASI HC A03/MF A01

Although research on smoking status and body composition reveals conflicting results, extant literature indicates that dietary intake, alcohol consumption, exercise, light/moderate versus heavy smoking, and the recency of smoking cessation are important variables to investigate. This study examined these variables in 1,820 Navy men. Of five body composition variables, only lean body mass was significantly ( $p$  less than .05) related to smoking status. However, heavy smokers exercised the least and never smokers exercised the most. Heavy smokers also tended to eat high-fat meat more often, and eat lean meat, leafy vegetables, fruit, and fiber less often than all other groups. Long-term quitters were more similar to never smokers and short-term quitters more similar to light/moderate smokers in eating patterns and consumption of low-fat foods. Heavy smokers drank twice as much alcohol and caffeine as never smokers and former smokers. In summary, smoking was associated with very low levels of exercise, a high-fat diet, and heavy consumption of alcohol—all of which are associated with the leading causes of death and disability in the United States. Navy health promotion efforts should continue to encourage smokers to quit as well as to modify other negative health behaviors that may accompany addiction to nicotine.

GRA

**N93-12145#** Army Research Inst. of Environmental Medicine, Natick, MA.

**SUSTAINING HEALTH AND PERFORMANCE IN THE COLD: ENVIRONMENTAL MEDICINE GUIDANCE FOR COLD-WEATHER OPERATION**

A. J. YOUNG, D. E. ROBERTS, D. P. SCOTT, J. E. COOK, and M. Z. MAYS Jul. 1992 64 p

(AD-A254328; USARIEM-TN-92-2) Avail: CASI HC A04/MF A01

This Technical Note reviews how the environment can impact on soldier health and performance during cold-weather operations. In addition, ways of coping with these environmental stresses are presented.

GRA

**N93-12427\*#** Alabama Univ., Huntsville. Environmental Lab. Section.

**ECLSS MEDICAL SUPPORT ACTIVITIES Final Report, 10 Apr. 1990 - 9 Apr. 1991**

WILLIAM J. CRUMP and MELVIN V. KILGORE, JR. 30 Apr. 1991 368 p

(Contract NAS8-36955)

(NASA-CR-184429; NAS 1.26:184429) Avail: CASI HC A16/MF A03

During the period from April 10, 1990 to April 9, 1991, the Consortium for the Space Life Sciences provided technical assistance to the NASA/MSFC water recovery efforts. This assistance was in the form of literature reviews, technical recommendations, and presentations. This final report summarizes the activities completed during this period and identifies those areas requiring additional efforts. The tasks which the University of Alabama in Huntsville (UAH) water recovery team addressed were either identified by MSFC technical representatives or chosen from those outlined in the subject statement of work. Author

**N93-12469#** Connecticut Univ., Storrs. Dept. of Communication Sciences.

**AUDITORY PERCEPTION Final Report, 1 Nov. 1989 - 31 Oct. 1990**

MARION F. COHEN 28 Aug. 1992 9 p

(Contract AF-AFOSR-0008-89)

(AD-A255061; AFOSR-92-0850TR) Avail: CASI HC A02/MF A01

During the past year we have continued our experiments designed to study the role of cross-spectrum coherent frequency change on signal detection. We have studied the effects of frequency glides and frequency jitter on cross-spectrum fusion, specifically addressing the issues of maximum spectral distance and harmonic relationship between signal and masker, and we have found that the improved detection which we reported last year cannot be solely attributed to either. We have spent considerable time developing two experimental paradigms to be used in our future studies of signal separation as it relates to separation of a direct sound from its echo. The results of initial experiments using these paradigms indicate that a signal following an identical waveform is considerably more difficult to detect than when it is leading that waveform. These results cannot be accounted for by traditional temporal masking. We have also continued our experiments using 'noise-problem people' as subjects in an effort to determine if their ability to perform these tasks is related to their difficulty listening in background noise. GRA

## 53

### BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A93-10334**

**AN ASSESSMENT OF TURKISH AIR FORCE PILOTS' ANXIETY AND DEPRESSION LEVELS**

MUZAFFER GETINGUC (Turkish Air Force Aeromedical Centre, Eskisehir, Turkey) Aviation, Space, and Environmental Medicine (ISSN 0095-6562) vol. 63, no. 10 Oct. 1992 p. 905-907. refs

Copyright

A method was developed for assessing stress levels in individuals, using the anxiety and depression scores in 345 active duty Turkish Air Force pilots and 70 nonflying Air Force officers (used as control group) subjected to Spielberger's State Trait Personality Inventory Trait and Zung's Depression Scale. It was found that the pilots had lower anxiety and depression scores than the nonfliers; the results are believed to be related to higher motivation and job satisfaction as well as to higher ego of fliers.

I.S.

## 53 BEHAVIORAL SCIENCES

**A93-11252#**

### **GROUND BASED SIMULATION IN TEST AND EVALUATION EDUCATION**

R. V. MILLER and R. B. RICHARDS (U.S. Navy, Naval Test Pilot School, Patuxent River, MD) /n AIAA Biennial Flight Test Conference, 6th, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers Washington American Institute of Aeronautics and Astronautics 1992 p. 1-9. (AIAA PAPER 92-4066)

The U.S. Naval Test Pilot School trains pilots, flight officers and engineers in the technical and managerial skills necessary to conduct aircraft and airborne systems test and evaluation. This paper outlines the curricula of the school with emphasis on the use of ground-based air vehicle simulation to show the applications and to conclude the associated attributes to test and evaluation education. Author

**A93-11253#**

### **THE USAF TEST PILOT SCHOOL FLIGHT CONTROL SYSTEMS CURRICULUM**

DANIEL GLEASON, MITCHELL B. CLAPP, ROBERT ESLINGER (USAF, Test Pilot School, Edwards AFB, CA), and SCOTT BUETHE (Calspan Corp., Buffalo, NY) /n AIAA Biennial Flight Test Conference, 6th, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers Washington American Institute of Aeronautics and Astronautics 1992 p. 10-16. (AIAA PAPER 92-4067)

The USAF Test Pilot School (TPS) addresses the testing of aircraft flight control systems (FCS) in a comprehensive manner. The PCS curriculum integrates academic courses with the extensive hands-on FCS test program. The FCS test program requires students to analyze, modify, simulate, and evaluate a variety of FCS designs for an approach and landing task. The evaluations are based on a fixed base ground simulation and the Calspan Learjet In-Flight Simulator. The use of an in-flight simulator for evaluating alternative designs provides students with a unique opportunity to apply validated flight test techniques learned during the academic year. The extensive hands-on nature of the program provides each student with the necessary insight and experience required for testing highly augmented flight control systems. Author

**A93-11254#**

### **TRAINING FOR AVIONICS EVALUATION**

SHAWN COYLE and ROBERT HUDSON (Ibis Aerosystems, Ltd., Charlton Musgrove, United Kingdom) /n AIAA Biennial Flight Test Conference, 6th, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers Washington American Institute of Aeronautics and Astronautics 1992 p. 17-23. (AIAA PAPER 92-4068) Copyright

A report is presented that examines the state of avionics evaluation and training, and focuses on the parallel between airframe and avionics in this context. Attention is given to the evolutionary parallel in testing and training of both avionics and airframe and powerplants. Consideration is given to part task simulator avionics systems, an avionics assessment rating scale, airborne training and some experiences in avionics teaching. R.E.P.

**A93-13410**

### **C.R.M. TRAINING FOR THE ADVANCED FLIGHT DECK**

EDDY L. RACCA (Airbus Industrie, Blagnac, France) /n Human factors on advanced flight decks; Proceedings of the Conference, London, United Kingdom, Mar. 14, 1991 London Royal Aeronautical Society 1991 p. 4.1-4.3. Copyright

A development history is presented for the involvement of human factors considerations in the progression of Airbus airliner cockpits, from the rather conventional (but pilot/copilot side-panel-equipped) A 300, which first flew in 1972, to the advanced-technology A 320, intensively employing video displays. Attention is given to the significance of cockpit resource

management, and to the Computerized System of Notation, Underscoring, and Statistics that has been used to deepen understanding of the experience of trainees. O.C.

**A93-13411**

### **AIRLINE TRAINING FOR ADVANCED TECHNOLOGY COCKPITS**

JEREMY BUTLER (British Airways, PLC, London, United Kingdom) /n Human factors on advanced flight decks; Proceedings of the Conference, London, United Kingdom, Mar. 14, 1991 London Royal Aeronautical Society 1991 p. 5.1-5.7. Copyright

One of the most important aspects of aircrew training in the mastery of advanced technology cockpits remains the clear establishment of the fundamentals of aircraft operation. On this foundation, training must proceed to give attention to the human factors of teamwork and coordination, in light of Line-Oriented Flight Training (LOFT) principles. In LOFT, the crew are asked to resolve problems and achieve the desired outcome within a realistic, hardware/software-defined in-flight environment. O.C.

**A93-13541**

### **PRELIMINARY INVESTIGATION ON PERSONALITY OF PILOTS**

QIJI ZHANG (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 108-112. In Chinese. refs

A personality investigation using a revised version of Cattell's questionnaire regarding the sixteen personality factors was conducted in aircrew, college students, and engineers. The results showed that the pilots presented higher stability and self-control, lower apprehension and nervousness, better adaptation and psychological health than those of the college students and engineers. It was also found that flight career and flight success were closely related to certain personality factors. Author

**N93-10278#** Rutgers - The State Univ., New Brunswick, NJ. Dept. of Psychology.

### **EYE MOVEMENTS AND VISUAL INFORMATION PROCESSING**

**Final Report, 1 Apr. 1988 - 30 Sep. 1991**

EILEEN KOWLER 30 Sep. 1991 6 p

(Contract AF-AFOSR-0171-88)

(AD-A250198; AFOSR-92-0268TR) Avail: CASI HC A02/MF A01

The research carried out during the period of the grant continued several lines of investigation on the way in which sensory and high-level influences contribute to the control of smooth and saccadic eye movements and on the perceptual implications of eye movements. We: (1) provided the first clear evidence that symbolic cues determine the direction of anticipatory smooth eye movements, showing that adaptive models, based on algorithms that modify pursuit according to prior performance cannot work; (2) showed that saccades to spatially extended targets are best understood by a serial model, with a selection stage followed by a spatial pooling mechanism; (3) showed that slow control is a velocity, not a position, corrective and; (4) showed that saccades (not shifts of attention) are required for accurate perception of poorly-segregating textures. These results are all consistent with the view that sensory and cognitive influences combine at a relatively high level of processing to provide a single, coherent input to the oculomotor system. Kowler also edited a book, published by Elsevier, containing major reviews and theoretical treatments of eye movements, vision and cognition. GRA

**N93-10321#** Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

### **A NEW TEST OF SCANNING AND MONITORING ABILITY: METHODS AND INITIAL RESULTS**

A. M. REVZIN and P. G. RASMUSSEN Mar. 1992 19 p (AD-A249123; DOT/FAA/AM-92/12) Avail: CASI HC A03/MF A01

Most tasks in the FAA's Air Traffic Control (ATC) system involve long duration scanning and monitoring for continuously

changing events occurring within a large visual space. Errors occur, so it is important to understand the causes of such errors to minimize or eliminate them by changing task design or improving personnel selection. This study describes a new system for testing scanning and monitoring abilities. The system, as currently implemented, is basically a character identification task. The characters are presented at random intervals and locations within two or more WorkAreas. The WorkAreas are defined as rectangular areas on a microcomputer display screen. They are filled with a constantly changing random dot pattern and may be located anywhere on the screen. The subject's task is to press a designated key on the computer keypad when a specified target character appears. Parametric manipulations can evaluate the effects on performance of many variables, including angular separation of WorkAreas, differential workloads in the WorkAreas, and effects of visual noise. We found a highly significant performance decrement as a function of increasing angular separation of WorkAreas. This is congruent with prior studies, which we interpret as a validation of our test procedure. We did not find practice effects, fatigue effects, or selective attention effects between WorkAreas. GRA

**N93-10658#** Retina Foundation, Boston, MA. Eye Research Inst.

**PERCEPTION OF LIGHTNESS AND BRIGHTNESS IN COMPLEX PATTERNS Annual Report, 1 May 1991 - 30 Apr. 1992**

LAWRENCE E. AREND, JR. 30 Jun. 1992 24 p  
(Contract AF-AFOSR-0377-89)  
(AD-A254093; AFOSR-92-0778TR) Avail: CASI HC A03/MF A01

Perception of surface color plays an important part in many everyday visual tasks. Psychophysical and neurophysiological data on early visual processes suggest a number of potential sensory limitations on the accuracy of surface-color perception. A new paradigm has been used to clarify the relationships between early visual processes and perception of achromatic surface colors (shades of gray). Psychophysical measurements of perceived surface color were made using achromatic stimulus patterns that were complex enough to support unambiguous perception of surfaces and lights. Lightness (apparent reflectance), brightness (apparent luminance) and local brightness contrasts were all measured using the same stimulus patterns. According to a number of models, lightness is closely related to local brightness contrast, but the data indicated that the relationship is more complicated than previously supposed. The brightness contrast data are well described by Stiles' threshold-vs-radiance curve, which is widely thought to be a characteristic of retinal adaptation processes. Both brightness and lightness are slightly higher on dark gray backgrounds than on white backgrounds. This perceptual error appear to be independent of illumination level. GRA

**N93-10662#** SAM Technology, Inc., San Francisco, CA.  
**MENTAL WORKLOAD ASSESSMENT IN THE COCKPIT: FEASIBILITY OF USING ELECTROPHYSIOLOGICAL MEASUREMENTS, PHASE 1 Final Technical Report, 1 Sep. 1990 - 28 Feb. 1991**

A. S. GEVINS and H. M. LEONG 30 Apr. 1992 49 p  
(Contract F49620-90-C-0077)  
(AD-A254138; AFOSR-92-0809TR) Avail: CASI HC A03/MF A01

Limitations in people's ability to process and respond to information have become a limiting factor in advanced military aircraft systems. Accordingly, the USAF OSR has been sponsoring research on measuring mental workload as a prerequisite to developing cockpit systems which take the pilot's mental state into account in optimizing overall system performance. During Phase 1, we performed a feasibility study in which we analyzed physiological data from four USAF fighter test pilots in search of ways to distinguish between two laboratory Mft which had the same stimulus and response components but differed in level of mental workload. Several electrophysiological measures, alone and in combination, were investigated for their discriminating power including regional brain electrical activity, scalp muscle potentials, and hem and eye activity. Measures were restricted to those which

could be recorded in the cockpit, and, in the case of brain signals, to those least likely to be contaminated by head, body and eye movement artifacts. Using a neural network algorithm, we achieved an average of 97 percent accuracy in classifying independent testing data for the four subjects as either high or low mental workload. GRA

**N93-10719#** Institute for Defense Analyses, Alexandria, VA.  
**RELATING FLYING HOURS TO AIRCREW PERFORMANCE: EVIDENCE FOR ATTACK AND TRANSPORT MISSIONS Final Report, Sep. 1991 - Jun. 1992**

COLIN P. HAMMON and STANLEY A. HOROWITZ Jun. 1992 39 p

(Contract MDA903-89-C-0003)  
(AD-A253988; IDA-P-2609; IDA/HQ-91-39384; AD-E501546)  
Avail: CASI HC A03/MF A01

This paper describes the development of quantitative relationships between the flight experience of military flying personnel and how well they perform important aspects of their mission. This research responds in part to concerns expressed by the General Accounting Office and Congress about the impact of reductions in the services' flying-hour programs. Research confirms the hypothesis that experience enhances proficiency in two ways: through the short-run honing of skills and through the long-run development of mastery. Measures of experience include flights and flying hours in the previous 7 to 60 days and the number of career flying hours. Econometric models and estimates of the strength of the links between these experience measures and two measures of performance are developed. The performance measures are bombing and tactical airdrop accuracy. In addition, the tradeoff between flying and flight simulator hours is examined for both Marine Corps and C-130 crewmembers. We conclude that although short-run measures are significant, the most important determinant of proficiency is total flying hours. This means that in an emergency it would be difficult to correct long-term deficiencies in accumulated flying hours. GRA

**N93-10979#** Royal Signals and Radar Establishment, Malvern (England).

**AN INTRODUCTION TO THE INFORMATION PROCESSING COMPONENTS OF THE BRAIN**

S. COLLINS 12 Jan. 1990 24 p  
(RSRE-MEMO-4350; BR113301) Copyright Avail: CASI HC A03/MF A01

Over the past decade there has been increasing interest in neurologically inspired computational techniques. This interest arises from the concurrence of two factors: (1) a growing list of interesting tasks for which serial digital computers are unsuitable; and (2) information gained from the application of new techniques in neurobiology. This text is intended to provide an introduction to neurobiological terms for physical scientists and engineers, with some pointers to further reading. As an introduction, little prior knowledge is assumed and the text begins with a short description of a generic neuron. This description is followed by more detailed discussions of those aspects of neurobiology of particular importance in information processing. The topics covered include the following. The electrical signals used to represent information. The ion conduction mechanisms employed by cells to support these signals. The behavior of cell and membranes and intercellular junctions. Finally, a few comments on the immediate implications of even a superficial understanding of neurobiology are included. Author

**N93-11081#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

**DEVELOPMENT OF A TACTILE PERCEIVED ATTITUDE TRANSDUCER Final Report, Oct. 1989 - Dec. 1991**

TAMARA L. CHELETTE Dec. 1991 21 p  
(AD-A253724; AL-SR-91-0002) Avail: CASI HC A03/MF A01

The objective of this effort was to design, build, and test a research device for measuring a research subject's perceived spatial orientation without the use of vision. The device consists of a multi-gimbaled structure that supports the dominant hand. A

restraint system prevents slippage and shear movement. The subject indicates the perceived horizontal plane by placing his or her hand parallel to that perceived plane. This report contains a complete description of the device as well as the results of some fundamental testing on human performance with the device. In addition, the use of the device in spatial orientation research on the Dynamic Environment Simulator, a multiaxial human centrifuge, is described. The Tactile Perceived Attitude Transducer (TPAT) described herein is a simple and effective technique for reporting perceived attitude. Its accuracy, precision, and discrimination characteristics match those of more constrained or more complex devices. GRA

**N93-11212** Politecnico di Milano (Italy). Dipartimento di Elettronica.

**ONTOLOGY OF MIND, SUBJECTIVE ONTOLOGY, AND THE EXAMPLE OF TEMPORAL EXPRESSIONS**

GABRIELLA AIRENTI (Turin Univ., Italy ) and MARCO COLOMBETTI Mar. 1992 30 p  
(REPT-92-018; ETN-92-92419) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

A methodology for cognitive science is discussed. Some important aspects of the ontology of mind, with the purpose of identifying the features that a sound theory of mental processes should have are considered. Relationships between theories of the mind and computational models are analyzed, and it is argued that no existing computational approach alone is able to account for all functionalities of a cognitive system. In the constructive part, it is argued that human representations embed a subjective ontology of the world, which can be studied systematically. How this study could be carried on is discussed, and the theory for a fragment of the subjective ontology of time is derived from linguistic data. ESA

**N93-11415#** Memphis State Univ., TN. Dept. of Psychology.  
**QUESTIONING MECHANISMS DURING COMPLEX LEARNING**  
**Final Report, Jan. 1990 - Jan. 1992**

ARTHUR C. GRAESSER 11 Mar. 1992 66 p  
(Contract N00014-90-J-1492)  
(AD-A247382; TR-92-1-ONR) Avail: CASI HC A04/MF A01

This research investigated human question asking and answering during comprehension and complex learning. The primary studies investigated questioning during tutoring. We collected and analyzed transcripts of tutoring sessions on research methods (college students) and basic algebra (7th graders). Student questions were 100 times as frequent in tutoring sessions as classroom settings, which might partially explain why learning is substantially better in tutoring. We analyzed the knowledge states, properties of questions, strategies, and interaction patterns of students and tutors. Students did attempt to self-regulate their knowledge by identifying knowledge deficits and asking questions that repair such deficits, but they need substantial training in improving question asking skills. Students' answers to deep questions (e.g., why, why-not, how, what-if) were poor in quality, so the tutor helped answer these questions in a collaborative process that took several conversational turns. In one auxiliary study, we designed a human-computer interface that facilitates the speed and quality of questioning, called the Point and Query (P and Q) interface. The frequency of student questions on the P and Q software was approximately 800 times that in a classroom setting. In a second auxiliary project, we investigated the stimulus conditions that trigger questions when students comprehend text and attempt to solve mathematics problems. GRA

**N93-11488#** Purdue Univ., West Lafayette, IN. Jet Propulsion Center.

**VISUAL PSYCHOPHYSICS OF EGOMOTION Annual Report, 1 Dec. 1990 - 30 Nov. 1991**

KATHLEEN TURANO 24 Feb. 1992 11 p  
(Contract AF-AFOSR-0154-91)  
(AD-A248349; AFOSR-92-0202TR) Avail: CASI HC A03/MF A01

Two psychophysical studies investigated an observer's ability to perceive self motion. In both studies, the stimuli were

computer-generated images simulating an observer moving relative to a volume of randomly-positioned dots. The first study investigated an observer's ability to determine whether s/he was moving forward along a straight or curved path as forward speed was varied. The results showed that with eye movements, the deviation required to detect a departure from a straight path increased with forward speed. When eye movements were restricted, the required deviation remained constant across forward speeds. A second study investigated the effectiveness of various sizes and retinal locations of the stimulus in determining the direction of a curved path. The results showed an increasing linear relationship between optimal size and retinal eccentricity. Given optimally-scaled stimuli, the central and peripheral retinal locations yielded equivalent performance. Finally, a computational model has been developed to emulate a human observer's ability to detect a curved path of motion. Computer simulations of the model have been run on a task to discriminate between a curved and straight path of motion. The simulation results closely match psychophysical data. GRA

**N93-11503#** Boston Univ., MA. Center for Adaptive Systems.  
**VISUAL PERCEPTION OF STRUCTURE FROM MOTION Final Report, 1 Nov. 1988 - 30 Apr. 1992**

JAMES T. TODD 30 Apr. 1992 7 p  
(Contract AF-AFOSR-0016-89)  
(AD-A253235; AFOSR-92-0703TR) Avail: CASI HC A02/MF A01

The research performed in this project has examined the abilities of human observers to perceive 3D form from different types of optical structure within moving or stationary visual images. The research has been organized into four general problem areas, including the low level detection of coherent motion, the analysis of 3D form from motion, the analysis of image shading and texture, and the identification of image contours. Our basic strategy in all of these areas has been to identify the key assumptions of current computational models; to test the psychological validity of those assumptions using appropriate psychophysical procedures; and, based on the results of those experiments, to develop alternative models that more closely match the perceptual capabilities of actual human observers. In contrast to most common methods of 3D image analysis, which are designed to compute precise metrical descriptions, our results have shown that human perception is primarily concerned with more abstract aspects of object structure, such as affine or ordinal properties, which are easier to computer and are more robust to uncontrolled changes in viewing conditions. GRA

**N93-11779#** Dynamics Research Corp., Wilmington, MA. Systems Div.

**DEVELOPMENT OF THE PERSONNEL-BASED SYSTEM EVALUATION AID (PER-SEVAL) PERFORMANCE SHAPING FUNCTIONS Final Report, Nov. 1986 - Aug. 1990**

LAWRENCE H. OBRIEN, ROBERT SIMON, and HARIHARAN SWAMINATHAN Jun. 1992 122 p  
(Contract MDA903-86-C-0412; DA PROJ. 2Q1-62785-A-791)  
(AD-A252820; ARI-RN-92-50) Avail: CASI HC A06/MF A02

This report describes how the Personnel-Based System Evaluation Aid (PER-SEVAL) performance shaping functions were developed. It describes how PER-SEVAL will use these functions to identify minimum levels of personnel characteristics for a particular contractor's design. Finally, procedures for future validation of the functions are outlined. The PER-SEVAL performance shaping functions were developed by conducting regression analyses of data obtained from the U.S. Army Research Institute for the Behavioral and Social Sciences' Project A database. They predict task performance as a function of personnel characteristics and training. Separate functions are provided for different types of tasks. Two types of training variables are used in the performance shaping functions--frequency and recency of practice. GRA

**N93-12225#** Iowa Univ., Iowa City.  
**META-ANALYSIS OF INTEGRITY TESTS: A CRITICAL EXAMINATION OF VALIDITY GENERALIZATION AND MODERATOR VARIABLES Final Report, 28 Sep. 1991 - 30 Jun. 1992**

D. S. ONES, C. VISWESVARN, and F. SCHMIDT Jun. 1992  
 99 p

(Contract N00014-91-J-4168)

(AD-A254681) Avail: CASI HC A05/MF A02

A comprehensive meta-analysis was conducted to investigate whether integrity test validities are generalizable and to estimate differences in validity due to potential moderating influences. The database included 665 validity coefficients across 576,464 data points. Results indicate that integrity test validities are positive and in many cases substantial for predicting both job performance and counterproductive behaviors on the job such as theft, disciplinary problems, and absenteeism. Validities were found to be generalizable. The estimated mean operational predictive validity of integrity tests for supervisory ratings of job performance is .41. For the criterion of counterproductive behaviors, results indicate that use of concurrent validation study designs may overestimate the predictive criterion-related validity applicable in selection situations. Our results based on external criterion measures (i.e., excluding self reports) and predictive validity studies using applicants indicate that integrity tests predict the broad criterion of organizationally disruptive behaviors better than they predict the narrower criterion of employee theft alone. Our results also indicated substantial evidence for the construct validity of integrity tests. Perhaps the most important conclusion of this research is that despite the influence of moderators, integrity test validities are positive across situations and settings. GRA

**N93-12252#** Air Force Systems Command, Brooks AFB, TX.  
**INTRODUCTION TO TRAINING DECISIONS MODELING TECHNOLOGIES: THE TRAINING DECISIONS SYSTEM Final Report, Jan. 1990 - Apr. 1990**

KERIC B. O. CHIN, THEODORE A. LAMB, WINSTON R. BENNETT, and DAVID S. VAUGHAN (McDonnell-Douglas Missile Systems Co., Saint Louis, MO.) Apr. 1992 27 p

(Contract AF PROJ. 1121)

(AD-A249862; AL-TP-1992-0014) Avail: CASI HC A03/MF A01

This paper is an introduction to the Training Decisions Modeling Technologies under development at the Armstrong Laboratory. These technologies are intended to support Air Force Training Managers by providing them with cost and resource information about the impact of their decisions on the AF training system. The Training Decisions System (TDS), which forms the baseline technologies for the research program, uses information about jobs performed by airmen, personnel assignment flows, course training content, and training resources to determine training capacities and the most cost-effective training options available. The TDS develops a model of a job specialty's Utilization and Training (U and T) pattern according to data collection results and simulates the flow of airmen through it. Based on this simulation, TDS tabulates the costs associated with training and evaluates the training capacity of the training system (i.e., the ability of the training system to provide training to a given number of airmen). GRA

**N93-12432#** Naval Aerospace Medical Research Lab., Pensacola, FL.

**THE OMPAT LEVEL 1 NEUROPHYSIOLOGICAL PERFORMANCE ASSESSMENT BATTERY: NPPAB Interim Report, Oct. 1989 - Oct. 1991**

D. L. REEVES, R. R. STANNY, G. F. WILSON, R. I. HERNING, and W. PICKWORTH Dec. 1991 32 p

(AD-A254840; NAMRL-MONO-43) Avail: CASI HC A03/MF A01

This report presents specifications and methodology for the tests of the Tri-service Neurophysiological Performance Assessment Battery (NPPAB). The NPPAB is designed to evaluate the effects of medical pharmaceuticals on military-relevant human performance. It is intended to serve as an initial screening tool that will identify neurological systems and functions adversely

affected by chemical agents. The tests of the NPPAB comprise seven electrophysiological procedures designed to assess the functioning of the visual, auditory, and somatosensory systems, as well as the higher-order processes of selective attention and short-term memory. GRA

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### MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**A93-11201**  
**DESIGN OF A DISPLAY SYSTEM FOR A HUMAN PILOT'S SUPERVISORY TASKS**

KEIJI TANAKA and KOHTARO MATSUMOTO Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663) vol. 40, no. 464 1992 p. 468-473. In Japanese. refs

The supporting displays for pilot operations are presented, such as flight management system (FMS), attitude director indicator (ADI), primary flight display (PFD), engine indication and crew alerting system (EICAS), and electronic centralized aircraft monitor (ECAM). The pilot supporting expert system is discussed and the cockpit advisory system is addressed. Y.P.Q.

**A93-11202**  
**HUMAN FACTORS IN THE 'GLASS COCKPIT'**

SATOSHI MURAKAMI and HIDETAKE SAKUMA Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663) vol. 40, no. 464 1992 p. 474-480. In Japanese. refs

The statistics of aircraft accident factors are analyzed. The evolution of transport aircraft automation is described, and the glass cockpit concept is discussed. Human factors in aviation and automation are studied. Y.P.Q.

**A93-11204**  
**SPACE ROBOTICS AND ITS MAN-MACHINE INTERFACE**

MITSUSHIGE ODA Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663) vol. 40, no. 464 1992 p. 486-490. In Japanese. refs

The use of space robotics for orbital operations is discussed. Applications associated with the Space Shuttle Orbiter Remote Manipulator System (SRMS) and the Engineering Test Satellite VII (ETS-VII) are addressed. Space robotic control technology and man-system integration standards are examined. Y.P.Q.

**A93-11287**  
**CONTROLLABILITY OF THE VOICE COMMAND SYSTEM - A PRELIMINARY STUDY**

NARUSUKE UTSUKI and YOSHINORI TAKEUCHI Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858) vol. 32, no. 4 Dec. 1991 p. 125-130. In Japanese. refs

The efficiency of the voice command controls was investigated by comparing the efficiencies of a keyboard, mouse buttons, and voice input in a compensatory tracking task. It was found that, among the three methods of control, voice command was the least effective one. The speech rate of one word per second may be maximal if an operator is involved in a continuous control task for more than a few 10 seconds. I.S.

**A93-12077\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**HUMAN SUPPORT FOR MARS EXPLORATION - ISSUES AND APPROACHES**

ANTHONY R. GROSS, LYNN D. HARPER, MICHAEL G. SHAFTO, JOAN VERNIKOS, BRUCE W. WEBBON, and WILLIAM E. BERRY (NASA, Ames Research Center, Moffett Field, CA) In Mars:

Past, present, and future; Proceedings of the Conference, Williamsburg, VA, July 16-19, 1991 Washington American Institute of Aeronautics and Astronautics 1992 p. 269-296. refs

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The preparations for a manned mission of the length associated with travel to Mars will strongly focus on the human crew, in order to best support their technical, physical, and psychological needs. Advanced life-support systems for both internal and external operations will be critical in both the transit vehicle and planetary surface habitat. Not only individual systems, but how they mutually interact and in turn affect the crew, will shape not only habitats but realistically foreseeable mission objectives. The long-term habitability of all accommodations will be a far more prominent design criterion than heretofore for the relevant engineering disciplines. O.C.

**A93-12078**

### **SMART SPACE SUITS FOR SPACE EXPLORATION**

BRAND N. GRIFFIN and PAUL HUDSON (Griffin-Hudson, Huntsville, AL) /n Mars: Past, present, and future; Proceedings of the Conference, Williamsburg, VA, July 16-19, 1991 Washington American Institute of Aeronautics and Astronautics 1992 p. 297-306. refs

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The Command/Control Pressure Suit (CCPS) design concept has been expanded beyond the concerns with EVA initially envisioned in 1987 to benefit from combined operations with such other lunar exploration hardware as rovers, in order to realize greater system efficiencies. The modular CCPS presented furnishes the further advantages of interchangeable hardware and low cost through commonality for lunar, Martian, and interplanetary space operations. The core component of the CCPS is the Rigid Upper Torso/Helmet assembly, which integrates internal displays with external visibility, thereby acting as a portable command center. The modularity of CCPS allows tailoring and upgrading to meet mission requirements for the next 30 years. O.C.

**A93-12222** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

### **DYNAMIC ANALYSIS TO EVALUATE VISCOELASTIC PASSIVE DAMPING AUGMENTATION FOR THE SPACE SHUTTLE REMOTE MANIPULATOR SYSTEM**

THOMAS E. ALBERTS, HOUGHUN XIA, and YUNG CHEN (Old Dominion Univ., Norfolk, VA) ASME, Transactions, Journal of Dynamic Systems, Measurement, and Control (ISSN 0022-0434) vol. 114, no. 3 Sept. 1992 p. 468-475. refs

(Contract NAS1-18687; NGT-70124)

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The effectiveness of constrained viscoelastic layer damping treatment designs is evaluated separately as passive control measures for low frequency joint dominated modes and higher frequency boom flexure dominated modes using a NASTRAN finite element analysis. Passive damping augmentation is proposed which is based on a constrained viscoelastic layer damping treatment applied to the surface of the manipulators' flexible booms. It is pointed out that even the joint compliance dominated modes can be damped to some degree through appropriate design of the treatment. O.G.

**A93-13288\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

### **RADIATION EXPOSURE PREDICTIONS FOR LONG-DURATION-STAY MARS MISSIONS**

SCOTT A. STRIEPE, LISA C. SIMONSEN, and JOHN E. NEALY (NASA, Langley Research Center, Hampton, VA) Aug. 1992 8 p. AIAA and AAS, Astrodynamics Conference, Hilton Head Island, SC, Aug. 10-12, 1992 refs

(AIAA PAPER 92-4584) Copyright

In this study, the ionizing radiation environment is estimated, using the Mission Radiation Calculation (MIRACAL) program, for several long-duration-stay Mars missions proposed for early in the 21st century. Both long-fast and minimum energy transfer missions

are evaluated, and their 30-day maximum, annual maximum, and total slab skin and blood-forming organ (BFO) doses are compared. When large flares were included while the astronauts were on the surface, the delivered dose did not significantly contribute to the total dose (less than 4 cSv BFO dose, or 8 percent of the guideline annual limit, for the most energetic event simulated) due to the substantial protection provided by the Martian atmosphere. However, dose delivered by large flares during transit is dependent on vehicle shielding and distance from the sun. All of the long-fast transfer missions studied had lower total and annual maximum doses than the corresponding minimum energy transfer missions (on average, 30 percent less for missions having no large flares and the shielding thicknesses evaluated in this study). For all the missions studied, having the astronauts spend one-third of their day during transit in a 10 g/sq cm storm shelter resulted in significantly lower total doses. Author

**A93-13331\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

### **SIMULATION AND FLIGHT TEST EVALUATION OF HEAD-UP-DISPLAY GUIDANCE FOR HARRIER APPROACH TRANSITIONS**

D. W. DORR, E. MORALEZ, III, and V. K. MERRICK (NASA, Ames Research Center, Moffett Field, CA) Aug. 1992 11 p. AIAA, Aircraft Design Systems Meeting, Hilton Head Island, SC, Aug. 24-26, 1992 refs

(AIAA PAPER 92-4233) Copyright

Position and speed guidance displays for STOVL aircraft curved, decelerating approaches to hover and vertical landing have been evaluated for their effectiveness in reducing pilot workload and improving performance. The NASA V/STOL Systems Research Aircraft, a modified YAV-8B Harrier prototype, was used to evaluate the displays in flight, while the NASA Ames Vertical Motion Simulator was used to extend the flight test results to instrument meteorological conditions (IMC) and to examine performance in various conditions of wind and turbulence. The simulation data showed close correlation with the flight test data, and both demonstrated the feasibility of the displays. With the exception of the hover task in zero visibility, which was Level-3, averaged Cooper-Harper handling qualities ratings given during simulation were Level-2 for both the approach task and the hover task in all conditions. During flight tests in calm and clear conditions, the displays also gave rise to Level-2 handling qualities ratings. Pilot opinion showed that the guidance displays would be useful in visual flight, especially at night, as well as in IMC. Author

**A93-13350#**

### **ADVANCED DISPLAYS FOR MILITARY OPERATIONS**

PHILIP A. KING (McDonnell Aircraft Co., Saint Louis, MO) Aug. 1992 13 p. AIAA, Aircraft Design Systems Meeting, Hilton Head Island, SC, Aug. 24-26, 1992

(AIAA PAPER 92-4243) Copyright

This paper provides an overview of military control and display technology; specifically, that in use or being researched for use in high performance military fighter/attack aircraft. The current state of the art is described, including glass cockpits, soft switches, Hands-On-Throttle-and Stick (HOTAS) controls, and night vision capabilities. Control and display technologies and concepts that are in work or being proposed for military aircraft in the next decade are also discussed, including touchscreens, speech recognition, helmet mounted displays, flat panel displays, and large situation displays. Author

**A93-13357\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

### **HIGH-SPEED CIVIL TRANSPORT - ADVANCED FLIGHT DECK CHALLENGES**

JAY R. SWINK and RICHARD T. GOINS (Douglas Aircraft Co., Long Beach, CA) Aug. 1992 7 p. AIAA, Aircraft Design Systems Meeting, Hilton Head Island, SC, Aug. 24-26, 1992 refs

(Contract NAS1-19345)

(AIAA PAPER 92-4231) Copyright

This paper presents the results of a nine month study of the

HSCAT flight deck challenges and assessment of its benefits. Operational requirements are discussed and the most significant findings for specified advanced concepts are highlighted. These concepts are a no nose-droop configuration, a far forward cockpit location and advanced crew monitoring and control of complex systems. Results indicate that the no nose-droop configuration is critically dependent on the design and development of a safe, reliable and certifiable synthetic vision system (SVS). This configuration would cause significant weight, performance and cost penalties. A far forward cockpit configuration with a tandem seating arrangement allows either an increase in additional payload or potential downsizing of the vehicle leading to increased performance efficiency and reductions in emissions. The technologies enabling such capabilities, which provide for Category III all-weather operations on every flight represent a benefit multiplier in a 20005 ATM network in terms of enhanced economic viability and environmental acceptability. A.O.

**A93-13408  
HUMAN FACTORS ON ADVANCED FLIGHT DECKS;  
PROCEEDINGS OF THE CONFERENCE, LONDON, UNITED  
KINGDOM, MAR. 14, 1991**

London Royal Aeronautical Society 1991 94 p.  
(ISBN 0-903409-85-2) Copyright

The present conference discusses the practical evaluation of advanced cockpit technologies, pilot attitudes to flight-deck automation, cockpit resource management training for advanced flight decks, and airline training for advanced technology cockpits. Also discussed are the relationship of pilots to advanced technology, methods for keeping pilots 'in the loop' in cockpit technology, vision-modeling applications for display optimization, civil spin-offs from military aircraft cockpit research, and advanced airliner cockpit research at RAE Bedford. (For individual items see A93-13409 to A93-13416) O.C.

**A93-13413  
KEEPING THE PILOT IN THE LOOP**

R. G. WHITE (Royal Aerospace Establishment, Bedford, United Kingdom) *In* Human factors on advanced flight decks; Proceedings of the Conference, London, United Kingdom, Mar. 14, 1991 London Royal Aeronautical Society 1991 p. 8.1-8.13. refs  
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A successful cockpit display system design will avoid the need for routine monitoring by the pilot; in addition, potentially high-workload tasks (such as directed flight) should not be allowed to compromise the pilot's awareness of other events in his environment. Attention is presently given to the ways in which integrated cockpit displays have been used to implement these criteria, and to the problems posed by the aggressive use of computers for operational decisionmaking in light of the criterion for maximum effective control by the pilot. O.C.

**A93-13414  
VISION MODELLING APPLICATIONS FOR DISPLAY  
OPTIMISATION**

PAUL EMMERSON (British Aerospace, PLC, Sowerby Research Centre, Bristol, United Kingdom) *In* Human factors on advanced flight decks; Proceedings of the Conference, London, United Kingdom, Mar. 14, 1991 London Royal Aeronautical Society 1991 p. 9.1-9.6. refs  
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A need is identified to produce a computer-based Design Tool to aid the optimization of psychophysical aspects of visual displays. The production of such a tool should allow the designer to interrogate a visual performance database to obtain the optimal display characteristics for a given application and then to view an emulation of the optimized display. The present paper is concerned with a description of one such tool, that seeks to integrate existing approaches to the problem of display design. As an example of this approach, an algorithm from a model of visual performance is used to predict the conspicuity of colored symbols on CRT displays. Author

**A93-13416  
ADVANCED CIVIL AIRLINER COCKPIT RESEARCH AT RAE  
BEDFORD**

ALAN LAING (Royal Aerospace Establishment, Civil Avionics Section, Bedford, United Kingdom) *In* Human factors on advanced flight decks; Proceedings of the Conference, London, United Kingdom, Mar. 14, 1991 London Royal Aeronautical Society 1991 p. 11.1-11.11. refs  
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A development status report is presented for efforts to envision an air traffic management scenario, giving attention to the cockpit display configurations needed for pilot interaction with the emerging ATC environment. The program has eliminated 3D and quasi-3D systems as plausible approaches, but conceived a simpler approach to the design of navigation display formats for a '4D' CRT-based 'pathway-in-the-sky' tube-graphics concept. Extensive simulations of the tubes-graphics are presented. O.C.

**A93-13534  
MODEL BUILDING, ALGORITHM AND SIMULATION OF THE  
PRESSURE CONTROL SYSTEM OF A CABIN**

FENGMING HU (Inst. of Space Medico-Engineering, Beijing, China) Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 47-52. In Chinese. refs

Model building and algorithm for the pressure control system of a cabin (a ground-based environment facility) were studied and the digital simulation was conducted. The method combining theoretical analysis with experimental results was used for building the model and the pole-assignment self-tuning was adopted as the algorithm. The recursive extended least square method with forget factor was used for parameter estimation. Through the computer-simulation the closed loop poles of the system could be chosen logically. It is very useful for engineering implementation. Author

**A93-13535  
A NEW PROTECTIVE BREATHING APPARATUS**

REN CHEN (Inst. of Space Medico-Engineering, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 1 1990 p. 53-57. In Chinese. refs

FHZ-1 breathing protective apparatus is a new kind of closed personal protective device which can be used with a protective suits and an oxygen supply mask to provide reliable protection for the personnel working under a hypoxic environment and/or contaminated atmosphere with toxic gases. This apparatus is based on the technology of ECLSS and particularly has the advantages of compact construction, small size, light weight and portability. The principle, construction, technological specification and function of this apparatus are briefly analyzed and evaluated in this paper. Author

**A93-13537  
A SOFTWARE FOR TESTING HUMAN'S ABILITY TO  
TROUBLE-SHOOT IN THE CONDITION OF MULTITASK**

WEI XIE (Xian Univ. of Electronic Science and Technology, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 85-90. In Chinese. refs

A software was developed for testing human ability in detecting errors and making decisions under multitask conditions. It provides an experimental approach for building multitask decision-making models. The following key problems solved in designing the software are discussed in this paper: (1) the algorithms for solving continuous systems and display of corresponding pictures on computer; (2) setting up a random queueing system and dynamic simulation; and (3) designing a friendly man-machine interface. Author

**A93-13539  
EVALUATION OF FINGER MOTOR REACTION IN FLYER  
WHEN HANDLING THROTTLE AND STICK**

BAOSHAN LIU (Inst. of Aviation Medicine, Beijing, China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837) vol. 3, no. 2 1990 p. 96-102. In Chinese. refs

## 54. MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

A total of 126 flyers were tested with a finger function tester. Reaction time and rate of accuracy of the fingers of both hands were recorded under the static and dynamic conditions. The obtained data were processed by means of a fuzzy priority queue approach. Author

**A93-13718**

### **SPECTRAL ANALYSIS OF VISUAL SYMBOLS**

WEIXIN XIE (Xian Electronics Univ., China) et al. *Space Medicine & Medical Engineering* (ISSN 1002-0837) vol. 3, no. 4 1990 p. 250-255. In Chinese. refs

It was studied how to express information by rationally using visual symbols for the man-machine visual information interface of man-machine-environment systems. A similarity measure for the symbols was established, and a psychological momentary-showing experiment was designed. Through calculations of the similarity and tests of a group of symbols, it is demonstrated that the theoretical values are in good agreement with actual human visual sense. Author

**A93-13721**

### **RELATIONSHIP BETWEEN ERP AND WORKLOAD IN MANUAL CONTROL**

XU ZHAO (Inst. of Space Medico-Engineering, Beijing, China) et al. *Space Medicine & Medical Engineering* (ISSN 1002-0837) vol. 3, no. 4 1990 p. 267-271. In Chinese. refs

The P300 amplitude elicited by different kinds of relevant events were analyzed in 7 subjects during manual control with three levels of tracking difficulty. The results indicated that the P300 amplitudes elicited by the auditory signal of the secondary task decreased as a function of tracking difficulty; in contrast, those elicited by the visual signal embedded in the primary task increased with an increase in tracking difficulty. This difference in changes of P300 amplitudes appeared to result from the competition or synergism in the resources between the primary and secondary tasks. P300 was selectively sensitive to the perceptual/cognitive demands imposed on the operators and could be employed as an index for workload assessment of manual control. Author

**A93-13723**

### **THE DEVELOPMENT OF A VISUAL COLOR CHECKERBOARD STIMULATOR**

YIHAO SHI (Beijing Inst. of Ophthalmology, China) and HENGJUN WANG (Beijing Dongfeng Television Factory, China) *Space Medicine & Medical Engineering* (ISSN 1002-0837) vol. 3, no. 4 1990 p. 282-284. In Chinese. refs

With the addition of color selection switches to NTCOLET CA-1000 VEP black-white stimulus, a compatible visual stimulator with 3 kinds of color checkerboard patterns, including black-red, black-blue and black-white, was developed. Preliminary VEP tests were done in normal subjects. As compared to color flicker stimulus, VEP waveforms were more stable under the color checkerboard stimulus. The VEP waveforms elicited by the new system resembled those of black-white checkerboard reversal and had more color effect in the information. Author

**N93-10217#** Battelle Columbus Labs., OH.

### **EVALUATION OF LIGHTWEIGHT AND LOW PROFILE COMMUNICATIONS DEVICES FOR RESPIRATORY PROTECTIVE SYSTEM 21 (RESPO 21) Final Report**

JAMES E. DVORSKY, G. F. RENNER, KEVIN M. TAYLOR, WILLIAM J. WILLIAMS, and KENNETH J. WOODRUFF Feb. 1992 33 p  
(Contract DLA900-86-C-2045)  
(AD-A253393) Avail: CASI HC A03/MF A01

The Chemical Research, Development, and Engineering Center (CRDEC) is entering development of the next generation of respiratory protection (RESPO 21) to replace the current M40 series of protective masks. One of the design goals of this development is to improve both face-to-face and electronic communications while wearing respiratory protection. Commercial voice amplification systems being evaluated for this application are too bulky for many

field applications. An evaluation of miniaturized communication systems was needed to expand the potential applications of voice enhancement. GRA

**N93-10261#** Anacapa Sciences, Inc., Fort Rucker, AL.

### **OPERATOR WORKLOAD PREDICTIONS FOR THE REVISED AH-64A WORKLOAD PREDICTION MODEL, VOLUME 1 Interim Report, Sep. 1988 - Dec. 1991**

DAVID B. HAMILTON and CARL R. BIERBAUM Jul. 1992 39 p  
(Contract MDA903-87-C-0523; DA PROJ. 2Q2-63007-A-793)  
(AD-A254198; ASI690-354-92-I; ARO-RN-92-61) Avail: CASI HC A03/MF A01

Under a previous contract, researchers used a composite scenario to conduct a comprehensive task analysis of the AH-64A attack mission. The analysis produced workload estimates and decision rules for developing an AH-64A workload prediction model. For this research, the task analysis/workload (TAWL) methodology was used to construct a workload prediction model. The TAWL Operator Simulation System (TOSS) was used to implement the model on an IBM-compatible microcomputer, and the original function and task analysis was refined to produce a more accurate simulation of crew task activity. In addition, the original workload rating scales used in the original analysis were replaced with equal-interval scales. The predictions generated by the model constructed for this research indicate that under optimum conditions (1) neither the pilot nor the copilot/gunner experiences excessive workload, (2) the pilot has higher overall workload than the copilot/gunner in most mission segments, and (3) AH-64A workload is high relative to other Army aircraft that have been analyzed for workload. This model can be used as a baseline for analyzing future modifications to the aircraft. GRA

**N93-10288#** Battelle Columbus Labs., OH.

### **EVALUATION OF AN ELECTRONICS SYSTEM CONCEPT FOR RESPIRATORY PROTECTION SYSTEM (RESPO 21) Final Report**

MARK T. BYRNE, RONALD P. HUCK, and KENNETH L. KIMES Apr. 1992 73 p  
(Contract DLA900-86-C-2045)  
(AD-A253394) Avail: CASI HC A04/MF A01

The primary objective was to develop a preferred electronics system concept for the RESPO-21 mask. This system concept was assembled and integrated with a lightweight mask for demonstration purposes. The demonstration unit was delivered to CRDEC separately. A secondary task objective was to identify component and subsystem enhancements necessary for the final fielded RESPO-21 system. The electronics system evaluation focused on three areas: communications assist, blower control, and power source. This report summarizes the technical approach and results obtained for each subsystem. An appendix to this report contains a detailed technical discussion and manufacturers' data sheets for selected components of the communications assist, blower, and power supply subsystems. GRA

**N93-10713#** Aeronautical Systems Div., Wright-Patterson AFB, OH.

### **KC-135 CREW REDUCTION FEASIBILITY DEMONSTRATION SIMULATION STUDY. VOLUME 3: TEST AND EVALUATION Final Report, Oct. 1990 - Oct. 1991**

JUSTIN D. RUEB, JAMES M. BARNABA, JOHN A. HASSOUN, ROSS A. DUDLEY, and G. F. WARD Mar. 1992 135 p  
(AD-A253931; ASD-TR-5004-VOL-3) Avail: CASI HC A07/MF A02

In support of the KC-135 Avionics Modernization Program, a two-person (no-nav) conceptual cockpit design (Vol. 2) was evaluated using man-in-the-loop simulation. This report is Volume 3 of a 3-volume technical report. The objectives of the study were twofold: (1) to demonstrate the feasibility of the design; and (2) given the feasibility, to generate the functional requirements necessary to make such a design work. These requirements could later be used by SPO engineers as an aid in developing specific specifications. The simulation used 10 KC-135 crews and 2 KC-10

crews to demonstrate the feasibility of the design. Each crew was required to fly several missions over a period of 1 week. Subjective and objective measures of performance and workload were taken during and after each flight. The subjective workload measures (Subjective Workload Assessment Technique - SWAT, Subjective Workload Dominance (SWORD) technique and the Modified Cooper-Harper scale - MCH) and the various performance measures (i.e., airspeed, altitude, time control, etc.) provided convergent results supporting the feasibility of the conceptual design. Questionnaire data provided an additional analysis for determining those functions/subsystems deemed necessary for mission success. Recommendations of the functional requirements are discussed. GRA

**N93-10890\*#** National Aeronautics and Space Administration, Washington, DC.

**NASA SPACE HUMAN FACTORS PROGRAM**

1992 34 p

(NASA-TM-108005; NAS 1.15:108005) Avail: CASI HC A03/MF A01

This booklet briefly and succinctly treats 23 topics of particular interest to the NASA Space Human Factors Program. Most articles are by different authors who are mainly NASA Johnson or NASA Ames personnel. Representative topics covered include mental workload and performance in space, light effects on Circadian rhythms, human sleep, human reasoning, microgravity effects and automation and crew performance. R.L.B.

**N93-10994#** Maryland Univ., College Park. Office of Research Administration and Advancement.

**COORDINATED ACTION IN 3-D SPACE Annual Interim**

**Report, 15 Dec. 1990 - 14 Jan. 1992**

ROBERT M. STINMAN 12 Mar. 1992 4 p

(Contract AF-AFOSR-0124-91)

(AD-A249830; AFOSR-92-0233TR) Avail: CASI HC A01/MF A01

This grant tests alternative hypotheses about mechanisms controlling gaze-shifts while manipulating nearby objects, viz., on-line feedback vs. learned, preplanned coordinated movements; and studies speed and accuracy of visually-guided arm movements. Work this year concentrated primarily on instrumentation: i.e., (1) a SUN workstation was procured and configured; (2) an interface between the Maryland RFM and a PC was constructed (this allowed old DEC computers to be retired); (3) a hands-on, calibrated workspace was constructed; and (4) software for data acquisition and analysis was developed. Progress was made with more intellectual activities while this new instrumentation was developed, viz., (1) a behavioral trigonometric technique was worked out for estimating the eyes's centers of rotation with the head free to move, (2) slow control was shown to be sensitive only to velocity and not to position (contrary to prior claims), (3) Pizlo completed a Ph.D thesis on shape constancy by human beings and computers, and (4) it was shown that unspaced word-texts could be read out-loud easily. This provocative finding makes great difficulties for all contemporary theories of reading because they assume that spaces in texts are required to parse words effectively. GRA

**N93-11279#** Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

**COMPARISONS OF MOLECULAR SIEVE OXYGEN CONCENTRATORS FOR POTENTIAL MEDICAL USE ABOARD COMMERCIAL AIRCRAFT Final Report**

HARVEY M. ENGLAND, JR., BRUCE C. WILCOX, JR., and GARNET A. MCLEAN Jun. 1992 10 p

(AD-A253648; DOT/FAA/AM-92/22) Avail: CASI HC A02/MF A01

Medically-impaired air travelers requiring supplemental oxygen must depend on airlines to provide oxygen cylinders. Performance, space, and cost are considerations in providing this service. Tests were conducted in an altitude chamber to assess the viability of Molecular Sieve Oxygen Concentrators (MSOC's) as an alternative. Five different MSOC's were placed in the altitude chamber, and connected to a mass spectrometer outside. Gas concentration

was digitized at one sample-per-second and stored on line via a microcomputer. Tests at ground level showed four of the five MSOC produced oxygen at 95 percent purity at 2 liters per minute flow, which was maintained until 13,000 feet. Increasing altitude resulted in graded reductions of oxygen levels. At 25,000 feet, only two MSOC withstood sudden decompression. Results of this study indicate that some MSOC indeed have the potential to provide oxygen for the medically-impaired air traveler. GRA

**N93-11559#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

**THE EFFECT OF VARIABLE SEAT BACK ANGLES ON HUMAN RESPONSE TO +GZ IMPACT ACCELERATIONS Interim**

**Report, Jul. 1986 - Apr. 1991**

CHRIS E. PERRY, DENA M. BONETTI, and JAMES W. BRINKLEY May 1991 137 p

(Contract AF PROJ. 7231)

(AD-A250673; AL-TR-1991-0110) Avail: CASI HC A07/MF A02

During 1986-1987, eighty-two human impact experiments were accomplished on a vertical deceleration tower to determine the influence of variable seat back angles on human dynamic response to short-duration acceleration applied in the +x axis. Subjects were exposed to acceleration at a level of 10 G using a vertical deceleration tower. The seat back angle varied as follows: (1) +5 deg (5 deg aft of vertical), (2) 0 deg (vertical), (3) -5 deg (5 deg forward of vertical), and (4) -10 deg (10 deg forward of vertical). The resultant seat loads in the z-axis did not show statistically significant differences as the seat back angle was varied. Data showed a trend for head acceleration in the -x axis to increase and for head acceleration in the +x axis to decrease as the seat back angle became more negative. This implies that cervical spine flexion increases as the seat back angle becomes more negative. This is supported by motion analysis using high-speed photography which indicated a trend for increased forward rotation of the head as the seat back angle became more negative. These experimental data will be used in the formulation of biodynamic models. GRA

**N93-11649\*#** National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

**THE LOCATOR SYSTEM FOR WANDERING INDIVIDUALS**

SHAYLA DAVIDSON Aug. 1992 21 p Original contains color illustrations

(NASA-TM-104754; S-688; NAS 1.15:104754) Avail: CASI HC A03/MF A01; 2 functional color pages

Configurations and operation strategies are described for a wanderer locator system based on wireless radio frequency communication designed to monitor elderly patients who may wander beyond safe perimeters in the home or in an institutional setting. The modular components of this wandering notification system are (1) portable transmitter/receivers to be worn or carried by the patient and the caretaker, (2) detectors to be mounted in doorways or other perimeters of a safe area, (3) programmable central processing units to control, communicate with, and/or trace the portable and remote devices, and (4) a cathode ray tube that can display information on patient location or system status. Photographs of all system components and illustrations of operations concepts are included. Author

**N93-11743#** Human Engineering Labs., Aberdeen Proving Ground, MD.

**SYSTEM FOR GENERATING DYNAMIC VIDEO IMAGERY FOR HUMAN FACTORS RESEARCH Final Report**

D. R. SHIRES, F. F. HOLLY, C. A. CHANG, J. MAZURCZAK, and S. P. SCHIPANI Feb. 1992 78 p

(AD-A248675; HEL-TN-3-92) Avail: CASI HC A05/MF A01

A computer-controlled system was developed which provides the capability to generate processed dynamic imagery for human factors research. Processing of the video may involve any operation such as enhancing, degrading, or adding overlays. This system may also be used during experimental trials to perform data collection and score subject responses. The system is comprised of several components: a computer, an image processor, two lapse video cassette recorders, and a custom built VCR control circuit.

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When possible, processing is performed as the video is being displayed to a subject. When processing complexity is too great, the video is processed before experimentation. The input to the system is imagery on a video tape. The imagery is processed frame by frame and the results are stored on the output video tape. Processing appears to be performed in real time when this resultant tape is played at the regular speed. The flexibility and cost effectiveness of the system make it an ideal developmental tool, test-bed, and simulator for the processing of dynamic visual imagery. The hardware and software for implementing the system are discussed in detail. GRA

**N93-11783#** North Carolina Univ., Chapel Hill. Dept. of Computer Science.

### **ADVANCED TECHNOLOGY FOR PORTABLE PERSONAL**

#### **VISUALIZATION Progress Report, Jan. - Jun. 1992**

FREDERICK P. BROOKS, JR. and HENRY FUCHS Jun. 1992 119 p

(Contract DAEA18-90-C-0044)

(AD-A253808) Avail: CASI HC A06/MF A02

Despite the recent avalanche of publicity on virtual reality, the state of the art in head-mounted displays is still at the 'toy' stage. Although extravagant claims are made almost daily on television and in the popular press, there is very little that can be usefully accomplished today with virtual reality technologies. We at UNC have been working since the early 1970s on aspects of these technologies and have been advancing the state of the art by a 'driving problem' approach; we let the needs of selected applications stimulate the direction of the technological developments and then test new results by their impact on solving the original application. We have been working on three application areas: molecular modeling, 3D medical imaging, and modeling of architectural interiors. GRA

**N93-11784#** Naval Research Lab., Washington, DC.

### **DIRECT MANIPULATION AND INTERMITTENT AUTOMATION IN ADVANCED COCKPITS Final Report**

JAMES A. BALLAS, CONSTANCE L. HEITMEYER, and MANUEL A. PEREZ 21 Jul. 1992 52 p

(AD-A253814; NRL/FR/5534-92-9375) Avail: CASI HC A04/MF A01

Increasing use of automation in computer systems, such as advanced cockpits, present special challenges in the design of user interfaces. The challenge is particularly difficult when automation is intermittent because the interface must support smooth transitions from automated to manual mode. A theory of direct manipulation predicts that this interface style will smooth the transition. Interfaces were designed to test the prediction and to evaluate two aspects of direct manipulation: semantic distance and engagement. Empirical results supported the theoretical prediction and also showed that direct engagement can have some adverse effects on another concurrent manual task. Generalizations of our results to other complex systems are presented. GRA

**N93-11812#** Hamilton Standard Div., United Aircraft Corp., Windsor Locks, CT.

### **SUBMARINE ADVANCED INTEGRATED LIFE SUPPORT SYSTEM (SAILS) PROGRAM Final Report, 1 Oct. 1990 - 1 Oct. 1991**

1 Oct. 1991 43 p

(Contract N00014-87-C-0790)

(AD-A253564; BD-92-02) Avail: CASI HC A03/MF A01

Next generation submarines will require more sophisticated ship systems as component volume, weight, reliability and acoustic signatures become critical tradeoff parameters. System effectiveness becomes particularly important as acquisition cost drives the selection of advanced technologies. General Electric exhibited foresight in the early 1980's by initiating IR and D efforts targeted at developing a modified electrolysis cell which simultaneously converts carbon dioxide to liquid organics and water to pure oxygen without the presence of gaseous hydrogen. This effort was augmented by contracts from the Naval Research Laboratory shortly thereafter. Although some progress was made

towards the goal, significant, consistent improvements in cathode performance were not realized until organometallic electrode structures were implemented in 1986 by Hamilton Standard. Research efforts were initiated under a contract with the Office of Naval Research in 1987, but the program was put on hold shortly thereafter due to naval funding limitations. GRA

**N93-11922\*#** Defense Advanced Research Projects Agency, Arlington, VA. Advanced Systems Technology Office.

### **FROM PILOT'S ASSOCIATE TO SATELLITE CONTROLLER'S ASSOCIATE**

DAVID L. NEYLAND, CARL LIZZA (Wright Lab., Wright-Patterson AFB, OH.), and PHILIP A. MERKEL (BDM International, Inc., Arlington, VA.) /n NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 2-8 Jan. 1992

Avail: CASI HC A02/MF A04

Associate technology is an emerging engineering discipline wherein intelligent automation can significantly augment the performance of man-machine systems. An associate system is one that monitors operator activity and adapts its operational behavior accordingly. Associate technology is most effectively applied when mapped into management of the human-machine interface and display-control loop in typical manned systems. This paper addresses the potential for application of associate technology into the arena of intelligent command and control of satellite systems, from diagnosis of onboard and onground of satellite systems fault conditions, to execution of nominal satellite control functions. Rather than specifying a specific solution, this paper draws parallels between the Pilot's Associate concept and the domain of satellite control. Author

**N93-11924\*#** McDonnell-Douglas Space Systems Co., Huntington Beach, CA. Space Station Div.

### **DISTRIBUTED ENVIRONMENTAL CONTROL**

GARY A. CLEVELAND /n NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 19-26 Jan. 1992

Avail: CASI HC A02/MF A04

We present an architecture of distributed, independent control agents designed to work with the Computer Aided System Engineering and Analysis (CASE/A) simulation tool. CASE/A simulates behavior of Environmental Control and Life Support Systems (ECLSS). We describe a lattice of agents capable of distributed sensing and overcoming certain sensor and effector failures. We address how the architecture can achieve the coordinating functions of a hierarchical command structure while maintaining the robustness and flexibility of independent agents. These agents work between the time steps of the CASE/A simulation tool to arrive at command decisions based on the state variables maintained by CASE/A. Control is evaluated according to both effectiveness (e.g., how well temperature was maintained) and resource utilization (the amount of power and materials used). Author

**N93-11930\*#** McDonnell-Douglas Space Systems Co., Houston, TX. Space Station Div.

### **INTELLIGENT FAULT MANAGEMENT FOR THE SPACE STATION ACTIVE THERMAL CONTROL SYSTEM**

TIM HILL and ROBERT M. FALTISCO /n NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 60-66 Jan. 1992

Avail: CASI HC A02/MF A04

The Thermal Advanced Automation Project (TAAP) approach and architecture is described for automating the Space Station Freedom (SSF) Active Thermal Control System (ATCS). The baseline functionally and advanced automation techniques for Fault Detection, Isolation, and Recovery (FDIR) will be compared and contrasted. Advanced automation techniques such as rule-based systems and model-based reasoning should be utilized to efficiently control, monitor, and diagnose this extremely complex physical system. TAAP is developing advanced FDIR software for use on

the SSF thermal control system. The goal of TAAP is to join Knowledge-Based System (KBS) technology, using a combination of rules and model-based reasoning, with conventional monitoring and control software in order to maximize autonomy of the ATCS. TAAP's predecessor was NASA's Thermal Expert System (TEXSYS) project which was the first large real-time expert system to use both extensive rules and model-based reasoning to control and perform FDIR on a large, complex physical system. TEXSYS showed that a method is needed for safely and inexpensively testing all possible faults of the ATCS, particularly those potentially damaging to the hardware, in order to develop a fully capable FDIR system. TAAP therefore includes the development of a high-fidelity simulation of the thermal control system. The simulation provides realistic, dynamic ATCS behavior and fault insertion capability for software testing without hardware related risks or expense. In addition, thermal engineers will gain greater confidence in the KBS FDIR software than was possible prior to this kind of simulation testing. The TAAP KBS will initially be a ground-based extension of the baseline ATCS monitoring and control software and could be migrated on-board as additional computation resources are made available. Author

**N93-11941\*#** Aerospace Corp., Los Angeles, CA.  
**ADVANCED SATELLITE WORKSTATION: AN INTEGRATED WORKSTATION ENVIRONMENT FOR OPERATIONAL SUPPORT OF SATELLITE SYSTEM PLANNING AND ANALYSIS**

STEWART A. SUTTON /in NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 133-141 Jan. 1992  
 Avail: CASI HC A02/MF A04

A prototype integrated environment, the Advanced Satellite Workstation (ASW), is described that has been developed and delivered for evaluation and operator feedback in an operational satellite control center. The current ASW hardware consists of a Sun Workstation and Macintosh II Workstation connected via an ethernet Network Hardware and Software, Laser Disk System, Optical Storage System, and Telemetry Data File Interface. The central mission of ASW is to provide an intelligent decision support and training environment for operator/analysts of complex systems such as satellites. There have been many workstation implementations recently which incorporate graphical telemetry displays and expert systems. ASW is a considerably broader look at intelligent, integrated environments for decision support, based upon the premise that the central features of such an environment are intelligent data access and integrated toolsets. A variety of tools have been constructed in support of this prototype environment including: an automated pass planner for scheduling vehicle support activities, architectural modeler for hierarchical simulation and analysis of satellite vehicle subsystems, multimedia-based information systems that provide an intuitive and easily accessible interface to Orbit Operations Handbook and other relevant support documentation, and a data analysis architecture that integrates user modifiable telemetry display systems, expert systems for background data analysis, and interfaces to the multimedia system via inter-process communication. Author

**N93-11976\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**HABITAT AUTOMATION**

RODNEY E. SWAB /in NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 391-398 Jan. 1992  
 Avail: CASI HC A02/MF A04

A habitat, on either the surface of the Moon or Mars, will be designed and built with the proven technologies of that day. These technologies will be mature and readily available to the habitat designer. We believe an acceleration of the normal pace of automation would allow a habitat to be safer and more easily maintained than would be the case otherwise. This document examines the operation of a habitat and describes elements of that operation which may benefit from an increased use of automation. Research topics within the automation realm are then

defined and discussed with respect to the role they can have in the design of the habitat. Problems associated with the integration of advanced technologies into real-world projects at NASA are also addressed. Author

**N93-11981\*#** ST Systems Corp., Lanham, MD.  
**OPERATOR VISION AIDS FOR SPACE TELEOPERATION ASSEMBLY AND SERVICING**

THURSTON L. BROOKS, ILHAN INCE, and GREG LEE /in NASA. Lyndon B. Johnson Space Center, Fifth Annual Workshop on Space Operations Applications and Research (SOAR 1991), Volume 1 p 412-421 Jan. 1992  
 Avail: CASI HC A02/MF A04

This paper investigates concepts for visual operator aids required for effective telerobotic control. Operator visual aids, as defined here, mean any operational enhancement that improves man-machine control through the visual system. These concepts were derived as part of a study of vision issues for space teleoperation. Extensive literature on teleoperation, robotics, and human factors was surveyed to definitively specify appropriate requirements. This paper presents these visual aids in three general categories of camera/lighting functions, display enhancements, and operator cues. In the area of camera/lighting functions concepts are discussed for: (1) automatic end effector or task tracking; (2) novel camera designs; (3) computer-generated virtual camera views; (4) computer assisted camera/lighting placement; and (5) voice control. In the technology area of display aids, concepts are presented for: (1) zone displays, such as imminent collision or indexing limits; (2) predictive displays for temporal and spatial location; (3) stimulus-response reconciliation displays; (4) graphical display of depth cues such as 2-D symbolic depth, virtual views, and perspective depth; and (5) view enhancements through image processing and symbolic representations. Finally, operator visual cues (e.g., targets) that help identify size, distance, shape, orientation and location are discussed. Author

**N93-12018\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**TECHNIQUES FOR OPTIMAL CROP SELECTION IN A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM**

ANN MCCORMACK, CORY FINN, and BETSY DUNSKY Aug. 1992 16 p

(Contract RTOP 199-61-12-42)

(NASA-TM-103950; A-92142; NAS 1.15:103950) Avail: CASI HC A03/MF A01

A Controlled Ecological Life Support System (CELSS) utilizes a plant's natural ability to regenerate air and water while being grown as a food source in a closed life support system. Current plant research is directed toward obtaining quantitative empirical data on the regenerative ability of each species of plant and the system volume and power requirements. Two techniques were adapted to optimize crop species selection while at the same time minimizing the system volume and power requirements. Each allows the level of life support supplied by the plants to be selected, as well as other system parameters. The first technique uses decision analysis in the form of a spreadsheet. The second method, which is used as a comparison with and validation of the first, utilizes standard design optimization techniques. Simple models of plant processes are used in the development of these methods. Author

**N93-12079#** Battelle Columbus Labs., OH.

**EVALUATION OF MULTILAYER MASK CONCEPT FOR RESPO 21 Final Report**

T. A. PETTENSKI Dec. 1991 148 p

(Contract DLA900-86-C-2045)

(AD-A253392) Avail: CASI HC A07/MF A02

The RESPO 21 multilayer mask is discussed. The following topics are covered: background, design goals, previous work, functional characteristics, design, prototype fabrication, and testing. GRA

**N93-12195\*#** Lockheed Engineering and Sciences Co., Houston, TX.

**ASTRONAUT CANDIDATE STRENGTH MEASUREMENT USING THE CYBEX 2 AND THE LIDO MULTI-JOINT 2**

**DYNAMOMETERS Final Report**

AMY E. CARROLL and ROBERT P. WILMINGTON May 1992 28 p

(Contract NAS9-17900)

(NASA-CR-185679; NAS 1.26:185679; LESC-30277) Avail: CASI HC A03/MF A01

The Anthropometry and Biomechanics Laboratory in the man-Systems division at NASA's Johnson Space Center has as one of its responsibilities the anthropometry and strength measurement data collection of astronaut candidates. The anthropometry data is used to ensure that the astronaut candidates are within the height restrictions for space vehicle and space suit design requirements, for example. The strength data is used to help detect abnormalities or isolate injuries to muscle groups that could jeopardize the astronaut's safety. The Cybex II Dynamometer has been used for strength measurements from 1985 through 1991. The Cybex II was one of the first instruments of its kind to measure strength and similarity of muscle groups by isolating the specific joint of interest. In November 1991, a LIDO Multi-Joint II Dynamometer was purchased to upgrade the strength measurement data collection capability of the Anthropometry and Biomechanics Laboratory. The LIDO Multi-Joint II Dynamometer design offers several advantages over the Cybex II Dynamometer including a more sophisticated method of joint isolation and a more accurate and efficient computer based data collection system. Author

**N93-12211\*#** Lockheed Engineering and Sciences Co., Houston, TX.

**METHODOLOGY ISSUES CONCERNING THE ACCURACY OF KINEMATIC DATA COLLECTION AND ANALYSIS USING THE ARIEL PERFORMANCE ANALYSIS SYSTEM Final Report**

R. P. WILMINGTON, GLENN K. KLUTE, ed., AMY E. CARROLL, ed., MARK A. STUART, ed., JEFF POLINER, ed., SUDHAKAR RAJULU, ed., and JULIE STANUSH, ed. Jun. 1992 63 p

(Contract NAS9-17900)

(NASA-CR-185689; NAS 1.26:185689; LESC-30302) Avail: CASI HC A04/MF A01

Kinematics, the study of motion exclusive of the influences of mass and force, is one of the primary methods used for the analysis of human biomechanical systems as well as other types of mechanical systems. The Anthropometry and Biomechanics Laboratory (ABL) in the Crew Interface Analysis section of the Man-Systems Division performs both human body kinematics as well as mechanical system kinematics using the Ariel Performance Analysis System (APAS). The APAS supports both analysis of analog signals (e.g. force plate data collection) as well as digitization and analysis of video data. The current evaluations address several methodology issues concerning the accuracy of the kinematic data collection and analysis used in the ABL. This document describes a series of evaluations performed to gain quantitative data pertaining to position and constant angular velocity movements under several operating conditions. Two-dimensional as well as three-dimensional data collection and analyses were completed in a controlled laboratory environment using typical hardware setups. In addition, an evaluation was performed to evaluate the accuracy impact due to a single axis camera offset. Segment length and positional data exhibited errors within 3 percent when using three-dimensional analysis and yielded errors within 8 percent through two-dimensional analysis (Direct Linear Software). Peak angular velocities displayed errors within 6 percent through three-dimensional analyses and exhibited errors of 12 percent when using two-dimensional analysis (Direct Linear Software). The specific results from this series of evaluations and their impacts on the methodology issues of kinematic data collection and analyses are presented in detail. The accuracy levels observed in these evaluations are also presented. Author

**N93-12229#** Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

**SUPER AUDITORY LOCALIZATION FOR IMPROVED HUMAN-MACHINE INTERFACES Annual Technical Report, 1**

Mar. 1991 - 29 Feb. 1992

NATHANIEL DURLACH 7 Jan. 1992 9 p

(Contract AF-AFOSR-0200-90)

(AD-A254699; AFOSR-92-0762TR) Avail: CASI HC A02/MF A01

Work during the period 3/1/91 - 2/29/92 has continued on the development of a hybrid stimulation system in which a virtual auditory environment is combined with a real visual environment. This system has been developed to help explore the effects of various transformations of auditory-localization cues on both resolution and response bias. Initial research has focused on the effects of altering the cues available to the listener for determining sound source direction in the horizontal plane. Of particular interest are alterations that magnify these cues and thus lead to supernormal performance. Although these experiments have not yet been completed, results to date indicate that current models of auditory behavior are adequate for predicting the observed changes in resolution but inadequate for predicting the observed change in response bias. GRA

**N93-12291#** Naval Air Warfare Center, Warminster, PA. Aircraft Div.

**EFFECTIVENESS OF NASA 1032 AND 1035 AND AIR FORCE 1030 AND 1034 UNITS IN PROTECTION AGAINST COLD**

**WATER HYPOTHERMIA Final Report, 7 Feb. - 28 Mar. 1991**

ANNETTE C. DREW, JONATHAN W. KAUFMAN, and GREGORY K. ASKEW 16 Aug. 1991 34 p

(AD-A255120; NAWCADWAR-92056-60) Avail: CASI HC A03/MF A01

Our lab examined the relative cold exposure protection afforded by two sets of clothing ensembles. One set consisted of National Aeronautics and Space Administration suits (NASA1032 and NASA1035) and the other consisted of Air Force suits (AF1030 and AF1034). Eight healthy male subjects wearing these ensembles were exposed on four separate occasions to cold water ( $T_{\text{sub water}}$  - 4.4 C) in an environmentally controlled chamber with cold ambient air temperature ( $T_{\text{sub air}}$  - 5.6 C). Each subject tested either a NASA or an Air Force set of clothing ensembles for the ability to keep body core temperature ( $T_{\text{sub re}}$ ) above 35 C (onset of hypothermia) in both head-out immersion and enclosed within a raft. Subjects in the NASA suits were given up to 6 hours for the immersion trials and 24 hours for the raft trials, although none of the subjects in either suit were able to endure the entire duration of the experiments due to a variety of reasons. The NASA1032 appeared to perform better than the NASA1035 in both immersion and raft trials as none of the NASA1032 subjects'  $T_{\text{sub re}}$  fell to 35 C and the mean change in  $T_{\text{sub re}}$  ( $\Delta T_{\text{sub re}}$ ) was somewhat smaller in the NASA1032 ( $p$  less than 0.06). Both NASA1032 and NASA1035 subjects showed comparable mean exposure duration times. GRA

**N93-12423#** Florida Inst. of Tech., Melbourne. Dept. of Mechanical and Aerospace Engineering.

**STUDIES OF A LASER/NUCLEAR THERMAL HARDENED BODY ARMOR Final Report, 31 Jan. - 30 Sep. 1991**

N. Y. MISCONI, GERALD J. CALDARELLA, and JOSEPH F. ROACH Aug. 1992 53 p

(Contract DA PROJ. 1L1-62786-AH-98)

(AD-A255128; NATICK-TR-92/130) Avail: CASI HC A04/MF A01

The problem of laser/nuclear hardening of body armors and other applications, such as rigid walls, etc., has been investigated in this study. Earlier results from studies of hardening against space systems, which were supported by the Air Force Office of Scientific Research (AFOSR) and carried out by the Principal Investigator during 1984 to 1989 are summarized. The concepts of particle layer and photon multiple scattering inside the layers were utilized in developing a laser shield to protect against laser weapons in the 0.22 to 2.4 micrometer region of the spectrum. Protection against the threats from CO2 laser weapons are

addressed, and the development of a protective shield is detailed. It is now possible to apply a coating that will protect against laser/nuclear threats and reduction of solar loads for 0.22 to 16 micrometers of the spectrum. Applications are expected for rigid walls (Army containers), human body armor, thermal jackets for military hardware, etc. Finally, a mathematical model was created to help predict how the laser hardening material will behave under specific constraints that have not yet been tested in the laboratory. Also, this model can be used to extrapolate the performance of similar materials/coatings in the mid- to far-infrared wavelengths and also predict the broadband performance. GRA

**N93-12486#** Naval Air Warfare Center, Warminster, PA. Aircraft Div.

**HUMAN PERFORMANCE IN COMPLEX TASK ENVIRONMENTS: A BASIS FOR THE APPLICATION OF ADAPTIVE AUTOMATION Final Report**

JEFFREY G. MORRISON, JONATHAN P. GLUCKMAN, and JOHN E. DEATON 1 Mar. 1992 11 p  
(AD-A255067; NAWCADWAR-92032-60) Avail: CASI HC A03/MF A01

There are a number of human performance issues that are highlighted by the application of adaptive automation technology to complex task environments. Few of these issues have received empirical human performance research. This paper describes those issues that have arisen with the Naval Air Warfare Center's Adaptive Allocation for Intelligent Cockpits (AFAIC) program. GRA

**N93-12491#** Institute for Defense Analyses, Alexandria, VA.  
**THE EFFECTS OF WEARING PROTECTIVE CHEMICAL WARFARE COMBAT CLOTHING ON HUMAN PERFORMANCE Final Report, Sep. 1989 - Aug. 1991**

HENRY L. TAYLOR and JESSE ORLANSKY Aug. 1991 203 p  
(Contract MDA903-89-C-0003)  
(AD-A250716; IDA-P-2433; IDA/HQ-90-36732; AD-E501518)  
Avail: CASI HC A10/MF A03

U.S. Department of Defense studies to measure performance decrements associated with wearing chemical warfare (CW) protective combat clothing indicate that heat stress produced seriously degraded human performance. Even when heat stress is not a significant factor, performance of many combat, combat support, and combat service support tasks is degraded. In most field studies, many crews of combat units became operationally ineffective due to voluntary withdrawal of individual crew members. Many combined arms, field studies, and laboratory studies indicate that when CW-protective combat clothing is worn performance is seriously degraded in the following areas: (1) the detection of targets, engagement time, and accuracy of fire; (2) manual dexterity tasks; and (3) psychological effects. Further, the degree of performance degradation varied with the tasks performed. Training in CW-protective combat clothing permits learning to modify procedures and consequently reduce negative effects, provided heat stress is not a significant factor. A growing body of evidence indicates there is inadequate training in the use of CW-protective combat clothing. A critical need exists for more and better training of skills needed under CW conditions. GRA

**N93-12508#** Anacapa Sciences, Inc., Fort Rucker, AL.  
**SELECTIVE FACTORS AFFECTING ROTARY WING AVIATOR PERFORMANCE WITH SYMBOLOGY SUPERIMPOSED ON NIGHT VISION GOGGLES**

JOHN W. RUFFNER, MONTY G. GRUBB, and DAVID B. HAMILTON Jul. 1992 69 p  
(Contract MDA903-87-C-0523)  
(AD-A254983; ASI690-349-91; ARI-RR-1622) Avail: CASI HC A04/MF A01

This report presents the findings of a review of the literature on night vision goggles (NVG's), head-up displays (HUD's), and helmet-mounted displays (HMD's). The review was conducted to identify factors affecting the performance of pilots using the NVG-HMD system that superimposes symbology on the NVG image. The perceptual and attentional problems associated with using NVG's, HUD's, and HMD's are well documented in the

literature, but they are not well understood. The literature suggests that use of the NVG-HMD system is likely to result in several perceptual and attentional problems, most notably errors in distance estimation, inappropriate division of attention, and spatial disorientation. A coordinated program of research on the NVG-HMD system should be undertaken using laboratory simulation devices, flight simulators, and operational aircraft. Priority should be given to investigating the effects of variables that are identified as important in the literature review, and of practical significance to the Army and that have not been determined by design decisions. GRA

**N93-12509#** Anacapa Sciences, Inc., Fort Rucker, AL.  
**AN EVALUATION OF CREW COORDINATION AND PERFORMANCE DURING A SIMULATED UH-60 HELICOPTER MISSION Interim Report, Jan. 1990 - Jun. 1991**

R. C. THORNTON, GEORGE L. KAEMPF, JOSEPH L. ZELLER, JR., and D. M. MCANUALTY Jul. 1992 75 p  
(Contract MDA903-87-C-0523)  
(AD-A254984; ASI690-344-91; ARI-RN-92-63) Avail: CASI HC A04/MF A01

This research was designed to develop measures of aircrew coordination and mission effectiveness and to identify crew coordination training requirements for U.S. Army rotary-wing flight. Twenty crews planned and conducted a three-segment mission scenario in the UH-60 Flight Simulator that exposed crews to situations requiring coordination. Crew performance and communications were recorded during the final two scenario segments, and three mission effectiveness measures were developed from the records: navigational accuracy, threat avoidance and evasion, and instrument approach. Communication rate, topics, functions, and content areas were analyzed as indexes of crew coordination. The results indicate that substantial differences in performance and communication profiles exist between crewmembers and across mission segments. There were significant relationships between crew coordination levels and performance on the three mission tasks. The results also indicate the need for aircrew coordination training for Army helicopter pilots. Five recommendations are made for an Army aircrew coordination training program. GRA

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### SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

**A93-11847**  
**ORGANIC MODELS OF INTERSTELLAR GRAINS**

K. WADA (Kyoto Univ., Japan), T. INAGAKI (Osaka Kyoiku Univ., Japan), and S. YABUSHITA (Kyoto Univ., Japan) Celestial Mechanics and Dynamical Astronomy (ISSN 0923-2958) vol. 54, no. 1-3 1992 p. 275-277. refs  
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Results of a number of experimental studies carried out to verify the claim that interstellar grains largely consist of organic material, including biological cells, are reported. The present spectroscopic studies on biological cells and organic extracts from carbonaceous compounds failed to identify the well-known 2200-A interstellar extinction peak with the organic material. C.A.B.

**N93-12319\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**AN OVERVIEW OF GRAVITATIONAL PHYSIOLOGY**

JAIME MIQUEL and KENNETH A. SOUZA Oct. 1991 59 p  
(Contract RTOP 107-30-31)  
(NASA-TM-102849; A-90237; NAS 1.15:102849) Avail: CASI HC A04/MF A01

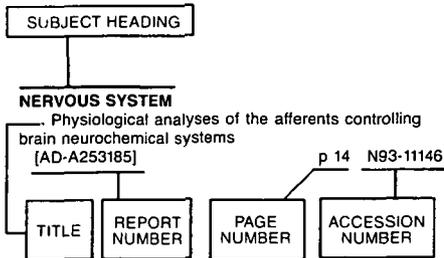
The focus of this review is on the response of humans and animals to the effects of the near weightless condition occurring

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aboard orbiting spacecraft. Gravity is an omnipresent force that has been a constant part of our lives and of the evolution of all living species. Emphasis is placed on the general mechanisms of adaptation to altered gravitational fields and vectors, i.e., both hypo- and hypergravity. A broad literature review of gravitational biology was conducted and the general state of our knowledge in this area is discussed. The review is specifically targeted at newcomers to the exciting and relatively new area of space and gravitational biology.

Author

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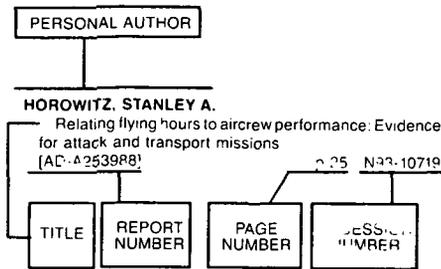
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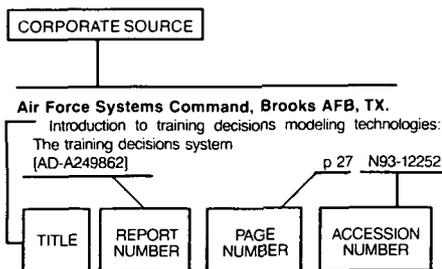
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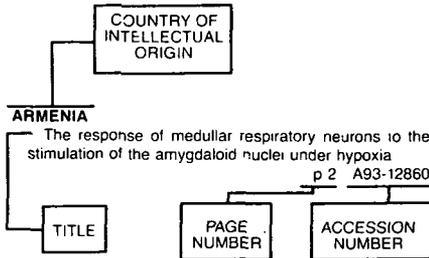
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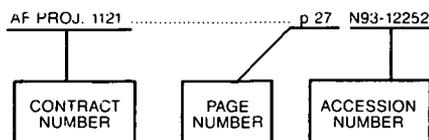
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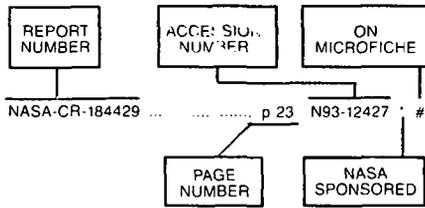
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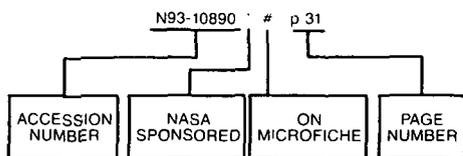
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