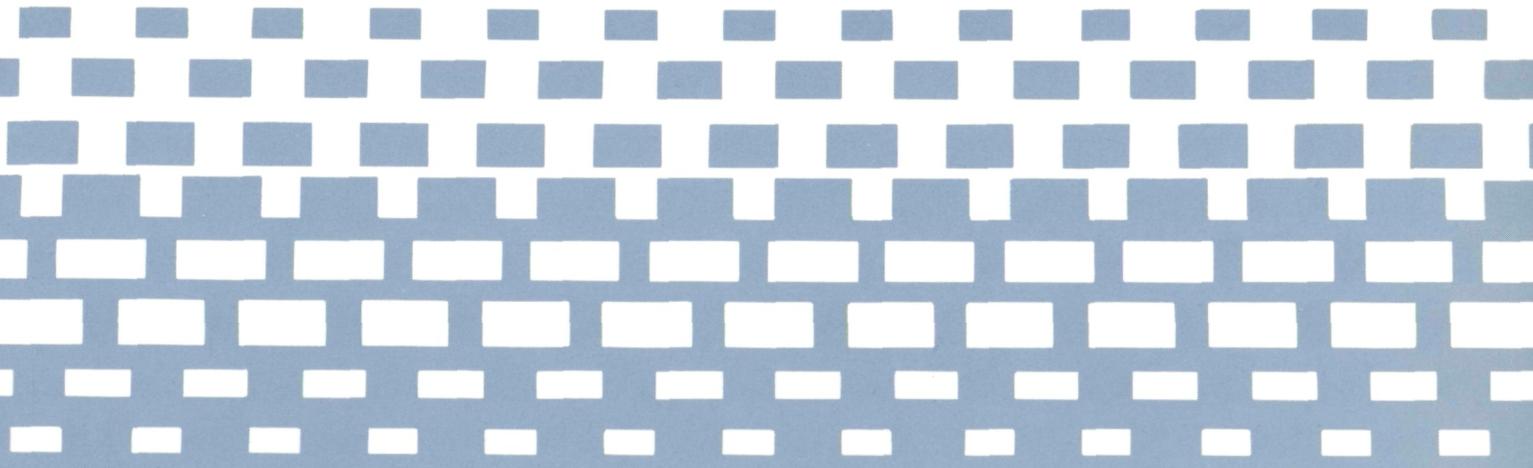


# AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration  
Scientific and Technical Information Program  
Washington, DC

1992

# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 205 reports, articles and other documents originally announced in September 1992 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:

STAR (N-10000 Series)	N92-26171 — N92-28222
IAA (A-10000 Series)	A92-40950 — A92-44894

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 1992 will be published in early 1993.

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

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## TYPICAL REPORT CITATION AND ABSTRACT

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ON MICROFICHE

**ACCESSION NUMBER** → N92-11637\*# ← **CORPORATE SOURCE**  
 Vanderbilt Univ., Nashville, TN. Dept. of Electrical Engineering.  
**TITLE** → **ROBOT GRAPHIC SIMULATION TESTBED Final Report**  
**AUTHORS** → GEORGE E. COOK, JANOS SZTIPANOVITS, CSABA BIEGL, GABOR KARSAI, and JAMES F. SPRINGFIELD ← **PUBLICATION DATE**  
 Aug. 1991  
 119 p Original contains color illustrations  
**CONTRACT NUMBER** → (Contract NAG8-690) ← **AVAILABILITY SOURCE**  
**REPORT NUMBERS** → (NASA-CR-188998; NAS 1.26:188998) ← **PRICE CODE**  
 Avail: NTIS HC/MF A06; ← **COSATI CODE**  
 12 functional color pages CSCL 06/11

The objective of this research was twofold. First, the basic capabilities of ROBOSIM (graphical simulation system) were improved and extended by taking advantage of advanced graphic workstation technology and artificial intelligence programming techniques. Second, the scope of the graphic simulation testbed was extended to include general problems of Space Station automation. Hardware support for 3-D graphics and high processing performance make high resolution solid modeling, collision detection, and simulation of structural dynamics computationally feasible. The Space Station is a complex system with many interacting subsystems. Design and testing of automation concepts demand modeling of the affected processes, their interactions, and that of the proposed control systems. The automation testbed was designed to facilitate studies in Space Station automation concepts.

Author

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**ACCESSION NUMBER** → A92-10353  
**TITLE** → **EFFECTS OF HYPOXIA AND COLD ACCLIMATION ON THERMOREGULATION IN THE RAT**  
**AUTHORS** → H. GAUTIER, M. BONORA, S. B. M'BAREK, and J. D. SINCLAIR ← **AUTHORS' AFFILIATION**  
 (Paris VI, University, France; Auckland, University, New Zealand)  
**JOURNAL TITLE** → Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Oct. 1991, ← **PUBLICATION DATE**  
 p. 1355-1363. Research supported by Institut National de la Sante et de la Recherche Medicale. refs

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Results are reported from an experimental study tracing the effects of hypoxia on thermoregulation and on the different sources of thermogenesis in rats before and after periods of 1-4 wk of cold acclimation. Measurements of the metabolic rate (VO<sub>2</sub>) and body temperature (T<sub>b</sub>) were made at 5-min intervals, and shivering activity was recorded continuously in groups of rats subjected to three protocols. Recordings were made in normoxia and in hypoxia on different days in the same animals. The results show that: (1) in noncold-acclimated (NCA) rats, cold exposure induced increases in VO<sub>2</sub> and shivering that were proportional to the decrease in T<sub>a</sub>; (2) in cold-acclimated (CA) rats in normoxia, for a given ambient temperature, VO<sub>2</sub> and T<sub>b</sub> were higher than in NCA rats, whereas shivering was generally lower; and (3) in both NCA and CA rats, hypoxia induced a transient decrease in shivering and a sustained decrease in nonshivering thermogenesis associated with a marked decrease in T<sub>b</sub> that was about the same in NCA and CA rats. It is concluded that hypoxia acts on T<sub>b</sub> control to produce a general inhibition of thermogenesis.

P.D.

A92-42697

**THE EFFECTS OF PREADMINISTRATION OF ASPARTATE AND ITS COMBINATION WITH A VITAMIN-COENZYME COMPLEX ON THE CATABOLISM OF L(C-14)-ASPARTATE IN TISSUES OF CERTAIN ORGANS OF MICE IN A HERMETICALLY SEALED SPACE [VLIANIE PREDVARITEL'NO VVEDENNOGO V ORGANIZM ASPARTATA I EGO SOCHETANIIA S VITAMINNO-KOFERMENTNYM KOMPLEKSOM NA KATABOLIZM L/C-14/-ASPARTATA V TKANIAKH NEKOTORYKH ORGANOV MYSHEI V USLOVIAKH GERMOZAMKNUTOGO PROSTRANSTVA]**

I. I. ABU ASALI, V. A. ROZANOV, and A. IA. ROZANOV (Odesskii Gosudarstvennyi Universitet, Odessa, Ukraine) *Fiziologicheskii Zhurnal* (Kiev) (ISSN 0201-8489), vol. 37, no. 6, Nov.-Dec. 1991, p. 66-70. In Russian. refs

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Mice placed into a hermetically sealed chamber exhibit an enhanced catabolism of aspartate in the encephalon. In this work, the effect of aspartate injections prior to placement of mice into a sealed chamber on this reaction was investigated using (C-14)-labeled aspartate. Results of counting of (C-14)O<sub>2</sub> contents in brain homogenates showed that the injection of L-aspartate (100 mg/kg) prolonged the life of the animals and caused an intensification of the aspartate catabolism; the accumulation of aspartate in the liver and the encephalon of these animals was increased, and its supply to the blood was more rapid. A simultaneous administration, in addition to aspartate, of a vitamin-coenzyme complex 'pentapiruvit' (which includes compounds that stimulate the key steps of the Krebs cycle) was found to intensify the protective effect of L-aspartate. I.S.

A92-42700

**DETERMINATION OF THE ROLE OF OXYGEN IN THE VITAL ACTIVITY OF AEROBIC ORGANISMS [POZNANIE ROLI KISLORODA V ZHIZNEDEIATEL'NOSTI AEROBNIKH ORGANIZMOV]**

A. N. LEONOV (Voronezhskii Gosudarstvennyi Meditsinskii Institut, Voronezh, Russia) *Fiziologicheskii Zhurnal* (Kiev) (ISSN 0201-8489), vol. 37, no. 6, Nov.-Dec. 1991, p. 116-123. In Russian. refs

Copyright

New experimental data on the evolutionary development were systematized and used to formulate the adaptive-metabolic concept of the curative effect of the hyperbaric oxygenation treatment. It was found that oxygen administered at a pressure of 300 kPa for 60 min exerts specific effects on the functions of the redox/antiredox system and a nonspecific effect which regulates the adaptation mechanisms of functional, metabolic, and morphogenic types, at various levels of vital activity, depending on the metabolic activity of the functional structures under abnormal conditions. I.S.

A92-43010

**EFFECTS OF 1,25-DIHYDROXYVITAMIN D<sub>3</sub> ON BONE METABOLISM OF RATS EXPOSED TO SIMULATED WEIGHTLESSNESS (SKELETAL UNLOADING)**

WEI CUI, ZHIZHIEN SHI, and ZHISHEN YU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) *Space Medicine & Medical Engineering* (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 46-50. In Chinese. refs

In order to examine the effects of 1,25-dihydroxyvitamin D<sub>3</sub> (D<sub>3</sub>) on the process of osteopenia following skeletal unloading, the rear limbs of rats were unloaded for 21 days. In the last seven days, the rats were given D<sub>3</sub> orally. Control animals were given 1,2-propanediol. The results showed that skeletal unloading reduced bone formation and serum concentration of P and reduced Ca and P content in bone as well as intestinal absorption of Ca. D<sub>3</sub> increased intestinal absorption of Ca and increased bone formation rate of tibia and serum concentration of Ca and P significantly. Ca and P content in femurs of experimental rats did not differ from that in the femur of control rats. The malon-dialdehyde (MDA) content in the kidneys of rats exposed to skeletal unloading increased significantly but that in liver did not, and administration of D<sub>3</sub> did not affect MDA content in kidneys and livers of rats exposed to skeletal unloading. The results indicate that D<sub>3</sub> can be used as a measure to improve bone metabolism in skeletal unloading. C.D.

A92-43026

**NEURAL BASIS OF SOME BASIC INTELLIGENCE FACTORS**

JIN-LONG LIU, XIANG-WEN HAN, and SHUANG-NING SU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) *Space Medicine & Medical Engineering* (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 157-169. refs

Task-related neurons were recorded from the frontal cortexes of rhesus monkeys performing tasks of visual and somatic discrimination, attention, and short-term memory, and decision making. The results indicated that there are neurons in the frontal cortex related to these tasks. Most of the neurons are located in a circumscribed area medial to the superior ramus of the arcuate sulcus in the frontal cortex. C.D.

A92-43028

**SPACE BREEDING OF DROSOPHILA**

XIANG-GAO LI and GONGZHI WANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) *Space Medicine & Medical Engineering* (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 176-178. In Chinese. refs

*Drosophila melanogaster* was bred in an auto-opening window system on board a near-earth orbiting recovery satellite for eight days. The mating, oviposit, hatching, growth, pupation, and emergence were all right. After eight days flight, a variety of tests indicated that *Drosophila melanogaster* can breed normally in space. No significant effect on their life-spans was observed. But there was a stop of three days in ovipositing of F<sub>1</sub> generation in the space flight group, and microgravity is probably the reason. Author

A92-43029

**BRAIN FUNCTION OF RABBITS IN HYPERGRAVITY STRESS BY MEANS OF ET ANALYSIS**

YUN-LONG ZHOU, LEI MEI, and YUEHONG LIU (Institute of Space

Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 179-184. In Chinese. refs

An encephalofluorograph technology (ET) developed on the basis of synergetic principles was used to investigate changes in rabbit brain parameters during +2 Gz stress. The results showed significant intensification of a series of brain systems. It is found that the neurochemical and other brain modulating systems were mobilized during the stress, in which neurotransmitter activation, the blood-vessel regulating mechanism, and the emotional and hypothalamic reaction may be involved. Selective increase in S2 and S3 reflects increased activity of the excitatory components of neuroglia and neuromediators related to intensified metabolism and general activation of the brain. The data provide some completely new information in the study of brain functions during hypergravity stress. C.D.

**A92-43031**

**A COMPUTER PROCEDURE FOR RECOGNIZING AND COUNTING OF BLOOD CELLS**

YI-PING JING (National University of Defence Technology, Changsha, People's Republic of China) and FU JIN (Chinese Academy of Sciences, Institute of Electronics, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 193-197. In Chinese. refs

The data of blood cells were obtained using an optical system and a TV camera. A computer procedure consisted of a spoke filter, an afterprocessing algorithm and a fast counting algorithm was applied. The method was based on the presumptions that red blood cells, white blood cells, and platelets are different in sizes and other features. They all have round shape and their size are known. The spoke filter made use of the direction feature of the edges. It can detect a large variety of shapes within a specified range of sizes. Once blood cells were detected, their numbers were counted with fast labeling algorithm effectively. As an example, red blood cells were discriminated from other blood cells. A 64 x 64 pixels digital image of blood cells was used in a computer simulation experiment. The whole process took less than 1 min on IBM PC/AT. Author

**A92-43032**

**COMBINED EFFECTS OF NOISE AND SIMULATED WEIGHTLESSNESS ON EEG AND HEARING THRESHOLD OF GUINEA PIGS**

SU-XIAN ZHENG, DAODE LI, LU YAN, and WEIQUAN QIAN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 198-202. In Chinese. refs

Changes of EEG and hearing threshold were observed for the evaluation of the effects of exposure to white noise of 80 dB(A) and white noise combined with simulated weightlessness at HDT-30 deg, respectively, on guinea pigs. The results showed that, when combined factors of white noise in 80 dB(A) and simulated weightlessness at HDT-30 deg were exerted continuously on guinea pigs for 8 days, the effects on EEG were not a simple addition of the two factors. A combined effect on hearing was also demonstrated, but it did not exceed the hearing impairment level. Author

**A92-43039**

**EFFECTS OF SPACE FLIGHT ON GENETIC MUTATIONS - THE DROSOPHILA MELANOGASTER SEX-LINKED RECESSIVE LETHAL ASSAY**

GONG-ZHI WANG, XIANGGAO LI, and XUEBIN YU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 268-272. In Chinese. refs

The space experiments with *Drosophila melanogaster* were carried out with a retrievable satellite in October of 1990. The *Drosophila melanogaster* flew around the earth for 8 days in the retrievable satellite, and mutation frequencies of the flies in the

satellite were studied in comparison with the control flies kept on the earth. The effects of the flight conditions on the genetic mutations of the *Drosophila melanogaster* were studied. The sex-linked recessive lethal frequencies were examined by using Muller-5 test. Results showed that there was no significant difference between the space-flown group and the ground control. However the mutation frequencies had a tendency to increase in the flight group. It suggested that protection against the effects of the flight conditions on genetics deserves further study. Author

**A92-43044**

**BONE LOCAL PROTEINS AND BONE REMODELING**

WEI CUEI Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 307-310. In Chinese. refs

Biochemical research on bone morphogenetic protein (BMP) is presented. The skeletal growth factor (SGF) is given and multinucleated cell formation is discussed. Y.P.Q.

**A92-43792**

**UNUSUAL RESISTANCE OF PEPTIDYL TRANSFERASE TO PROTEIN EXTRACTION PROCEDURES**

HARRY F. NOLLER, VERNITA HOFFARTH (California, University, Santa Cruz), and LUDWIKA ZIMNIAK (California, University, Santa Cruz; University of Arkansas for Medical Sciences, Little Rock) Science (ISSN 0036-8075), vol. 256, no. 5062, June 5, 1992, p. 1416-1419. refs

(Contract NIH-GM-17129)

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Peptidyl transferase, the ribosomal activity responsible for catalysis of peptide bond formation, is resistant to vigorous procedures that are conventionally employed to remove proteins from protein-nucleic acid complexes. When the 'fragment reaction' was used as a model assay for peptide bond formation, *Escherichia coli* ribosomes or 50 S subunits retained 20 to 40 percent activity after extensive treatment with proteinase K and SDS, but lost activity after extraction with phenol or exposure to EDTA. Ribosomes from the thermophilic eubacterium *Thermus aquaticus* remained more than 80 percent active after treatment with proteinase K and SDS, which was followed by vigorous extraction with phenol. This activity is attributable to peptidyl transferase, as judged by specific inhibition by the peptidyl transferase-specific antibiotics chloramphenicol and carbomycin. In contrast, activity is abolished by treatment with ribonuclease T1. These findings support the possibility that 23 S ribosomal RNA participates in the peptidyl transferase function. Author

**A92-43793**

**AMINOACYL ESTERASE ACTIVITY OF THE TETRAHYMENA RIBOZYME**

JOSEPH A. PICCIRILLI, TIMOTHY S. MCCONNELL, ARTHUR J. ZAUG (Colorado, University, Boulder), HARRY F. NOLLER (California, University, Santa Cruz), and THOMAS R. CECHE (Colorado, University, Boulder) Science (ISSN 0036-8075), vol. 256, no. 5062, June 5, 1992, p. 1420-1424. refs

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The active site of the *Tetrahymena* ribozyme was engineered to bind an oligonucleotide derived from the 3-prime end of N-Formyl-methionyl-tRNA(fMet). This ribozyme catalyzes the hydrolysis of the aminoacyl ester bond to a modest extent 5 to 15 times greater than the uncatalyzed rate. Catalysis involves binding of the oligonucleotide to the internal guide sequence of the ribozyme and requires Mg(2+) and sequence elements of the catalytic core. The ability of RNA to catalyze reactions with aminoacyl esters expands the catalytic versatility of RNA and suggests that the first aminoacyl tRNA synthetase could have been an RNA molecule. Author

**A92-44385\*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

**THERMOPHYSICAL PROPERTIES OF LYSOZYME (PROTEIN) SOLUTIONS**

JIACHING LIU and WEN-JEI YANG (Michigan, University, Ann Arbor) Journal of Thermophysics and Heat Transfer (ISSN

0887-8722), vol. 6, no. 3, July-Sept. 1992, p. 531-536. refs  
(Contract NAG3-903)  
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Thermophysical properties of protein solutions composed of the lysozyme crystals with a 0.1 M sodium acetate and 5 percent NaCl solution as the buffer (pH = 4.0) are determined. The properties being measured include specific heat, thermal conductivity, dynamic viscosity, and surface tension. The protein concentrations are varied. Thermal diffusivity is calculated using the measured results. The purpose of the research is to measure thermophysical properties of lysozyme solutions which would serve as the data bank for controlling and modeling the crystal growth process on earth as well as in space. Author

**A92-44421**

**MORPHOMETRIC ULTRASTRUCTURAL EVALUATION OF SATELLITE CELLS OF THE SOLEUS MUSCLE IN RATS SUBJECTED TO WEIGHTLESSNESS CONDITIONS IN THE BIOSPUTNIK 936**

WANDA BARANSKA, MARIANNA MARCINIAK, and WOJCIECH BARAN (Warsaw, Medical Academy, Institute of Biostructure, Poland) *Postępy Astronautyki* (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 25-32. Research supported by Polish Academy of Sciences. refs  
Copyright

The aim of the study was morphometric ultrastructural evaluation of satellite cells of the soleus muscle in rats kept for 21 days in the Biosputnik 936. Changes were found both in the nucleus and the cytoplasm, suggesting a degenerative process in the satellite cells of animals during space flight. Author

**A92-44542\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**PERCEIVED CONTROL IN RHESUS MONKEYS (MACACA MULATTA) - ENHANCED VIDEO-TASK PERFORMANCE**

DAVID A. WASHBURN, WILLIAM D. HOPKINS, and DUANE M. RUMBAUGH (Georgia State University, Atlanta) *Journal of Experimental Psychology: Animal Behavior Processes* (ISSN 0097-7403), vol. 17, no. 2, 1991, p. 123-129. Research supported by NIH and Georgia State University. refs  
(Contract NAG2-438)  
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This investigation was designed to determine whether perceived control effects found in humans extend to rhesus monkeys (*Macaca mulatta*) tested in a video-task format, using a computer-generated menu program, SELECT. Choosing one of the options in SELECT resulted in presentation of five trials of a corresponding task and subsequent return to the menu. In Experiments 1-3, the animals exhibited stable, meaningful response patterns in this task (i.e., they made choices). In Experiment 4, performance on tasks that were selected by the animals significantly exceeded performance on identical tasks when assigned by the experimenter under comparable conditions (e.g., time of day, order, variety). The reliable and significant advantage for performance on selected tasks, typically found in humans, suggests that rhesus monkeys were able to perceive the availability of choices. Author

**A92-44543\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**IMPAIRED PERFORMANCE FROM BRIEF SOCIAL ISOLATION OF RHESUS MONKEYS (MACACA MULATTA) - A MULTIPLE VIDEO-TASK ASSESSMENT**

DAVID A. WASHBURN and DUANE M. RUMBAUGH (Georgia State University, Atlanta) *Journal of Comparative Psychology* (ISSN 0735-7036), vol. 105, no. 2, 1991, p. 145-151. Research supported by Georgia State University. refs  
(Contract NAG2-438; NIH-HD-06016)  
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Social isolation has been demonstrated to produce profound and lasting psychological effects in young primates. In the present investigation, two adult rhesus monkeys (*Macaca mulatta*) were isolated from one another for up to 6 days and tested on 7 video tasks designed to assess psychomotor and cognitive functioning.

Both the number and quality (i.e., speed and accuracy) of responses were significantly compromised in the social isolation condition relative to levels in which the animals were tested together. It is argued that adult rhesus are susceptible to performance disruption by even relatively brief social isolation, and that these effects can best be assessed by a battery of complex and sensitive measures. Author

**A92-44631**

**INFLUENCE OF AIRWAY RESISTANCE ON HYPOXIA-INDUCED PERIODIC BREATHING**

F. SERIES, I. SERIES, L. ATTON, and A. BLOUIN (Hopital Laval; Universite Laval, Sainte Foy, Canada) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 72, no. 6, June 1992, p. 2128-2133. Research supported by Association Pulmonaire du Quebec and National Centre of Excellence of Canada. refs  
Copyright

The effect of changes in upper airway pressure on the dynamic response of ventilation to hypoxic disturbances in spontaneously breathing dogs was studied. Supralaryngeal pressure, instantaneous respiratory flow, end-expiratory lung volume, and inspiratory and expiratory O<sub>2</sub> and CO<sub>2</sub> were recorded at baseline and after a 1.5 minute hypoxic stimulus. During recovery airway resistance was modified by changing the composition of inspired gas; air, He, and SF<sub>6</sub> were used in random order (respective densities, 1.12, 0.42, and 4.2 g/l). During the tests the hypoxemic and hypocapnic levels and hypoxia induced hyperventilation were identical for different stimuli. Supralaryngeal resistance at peak flows was strongly influenced by the composition of inspired gas: 8.8 +/- 1.8 and 6.9 +/- 1.7 (SE)cmH<sub>2</sub>O/l s with air, 7.2 +/- 2.2 with He, 21.9 +/- 5.5 with SF<sub>6</sub> (P less than 0.05). During the posthypoxic period ventilatory fluctuations were consistently observed, and were significantly higher for SF<sub>6</sub> than the other gases. A significant positive relationship between peak flow supralaryngeal resistance of hyperpneic breath of periodic breathing cycles and the strength of these fluctuations was observed. It was concluded that the instability of the respiratory control system after a hypoxic disturbance is influenced by negative airway pressure. A.O.

**A92-44633\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**EFFECT OF HINDLIMB UNWEIGHTING ON TISSUE BLOOD FLOW IN THE RAT**

K. S. MCDONALD, M. D. DELP, and R. H. FITTS (Marquette University, Milwaukee, WI; Georgia, University, Athens) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 72, no. 6, June 1992, p. 2210-2218. refs  
(Contract NAG2-212)  
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This study characterized distribution of blood flow in the rat during hindlimb unweighting (HU), and post-HU standing and exercise. The relationship between reduced hindlimb blood flow and the previously observed elevation in anaerobic metabolism observed with contractile activity in the atrophied soleus muscle was examined (Witzmann et al., 1992). Blood flow was measured during unweighting, normal standing, and running on a treadmill (15 m/min), after 15 days of HU or cage control. For another group blood flow was measured during preexercise treadmill standing and treadmill running. During unweighting, PE standing, and running no difference in soleus blood flow was observed between groups. Muscles composed mainly of fast twitch glycolytic fibers received greater blood flow during chronic unweighting. With exercise blood flow to visceral organs was reduced in control animals, a similar change was not seen in 15 day HU rats. These changes suggest a reduction in the ability of the sympathetic nervous system to distribute cardiac output after chronic HU. A reduction in blood flow to the soleus during exercise was not observed after HU and so does not explain the increased dependence of the atrophied soleus on anaerobic energy production during contractile activity. A.O.

## 51 LIFE SCIENCES (GENERAL)

A92-44634

### BRAIN ADAPTATION TO CHRONIC HYPOBARIC HYPOXIA IN RATS

JOSEPH C. LAMANNA, LISA M. VENDEL, and RUTH M. FARRELL (University Hospitals; Case Western Reserve University, Cleveland, OH) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 72, no. 6, June 1992, p. 2238-2243. refs  
(Contract NIH-HL-42215; NIH-NS-22077)  
Copyright

Rats were exposed to hypobaric hypoxia (0.5 atm) for up to 3 wk. Hypoxic rats failed to gain weight but maintained normal brain water and ion content. Blood hematocrit was increased, and brain blood flow was increased but was not different from normobaric normoxic rats after 3 wk of hypoxia. Sucrose space, as a measure of brain plasma volume, was not changed under any hypoxic conditions. The mean brain microvessel density was increased. The results indicate that hypoxia elicits three main responses that affect brain oxygen availability. The acute effect of hypoxia is an increase in regional blood flow, which returns to control levels on continued hypoxic exposure. Longer-term effects of continued moderate hypoxic exposure are erythropoiesis and a decrease in intercapillary distance as a result of angiogenesis. The rise in hematocrit and the increase in microvessel density together increase oxygen availability to the brain to within normal limits, although this does not imply that tissue  $P_{O_2}$  is restored to normal. Author

A92-44635

### VENTILATORY AND HEMATOPOIETIC RESPONSES TO CHRONIC HYPOXIA IN TWO RAT STRAINS

L. C. OU, J. CHEN, E. FIORE, J. C. LEITER, T. BRINCK-JOHNSEN, G. F. BIRCHARD, G. CLEMONS, and R. P. SMITH (Dartmouth College, Hanover, NH; Lawrence Berkeley Laboratory, Berkeley, CA) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 72, no. 6, June 1992, p. 2354-2363. refs  
(Contract NIH-HL-21159; NIH-HL-01998)  
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Two strains of rats, Hilltop (H) and Madison (M), with different susceptibilities to altitude were used to study the effects of chronic altitude exposure. H rats develop greater polycythemia, hypoxia and pulmonary hypertension. Ventilation, pulmonary gas exchange, tissue oxygenation, and hematologic adaptations were studied during a 50 day exposure to a simulated altitude (HA) of 5500 m. Under sea level conditions no strain differences were observed. During the first 14 days of hypoxic exposure EPO was increased and erythroid activity was greater in the H rats, other variables were equivalent. By day 14, H rats showed higher erythroid activity, hematocrit (Hct) and EPO levels, lower  $P_{aO_2}$  and  $P_{rVO_2}$ , and equivalent VE and  $P_{aCO_2}$ . These changes persisted with continued exposure, but Hct increase was greater in H rats. Later in hypoxic exposure,  $P_{aO_2}$  and  $P_{rVO_2}$  were significantly lower in H rats despite increased  $O_2$ -carrying capacity. No strain differences at SL or HA in ventilatory responses to hypercapnia, hypoxia, or several other factors were observed. It was concluded that the first step in the pathogenesis of the maladaptation of H rats to HA is increased production of EPO at equivalent levels of hypoxia early in hypoxic exposure. No evidence was found that differences in VE contribute to the variable susceptibility to hypoxia in the two rat strains. A.O.

A92-44655

### NEW INSIGHTS ON THE COMMA-LESS THEORY

ENRIQUE MERINO, PAULINA BALBAS, and FRANCISCO BOLIVAR (Universidad Nacional Autonoma de Mexico, Coyoacan, Mexico) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 251-254. refs  
Copyright

The 'commaless' hypothesis for a step in the early evolution of the translation apparatus emphasizes the advantages of a RNY coding pattern in primitive RNA adaptor-catalyst system. A statistical model purporting to refute this theory is recently reconsidered within the framework of an elimination of the bias due to (1) the absence of stop codons in the open reading frame,

and (2) the amino acid composition of bacterial genes. The results thus obtained sustain the biological consequentiality of the RNY coding pattern. O.C.

N92-26203# California Univ., Berkeley. Lawrence Berkeley Lab.

### LIFE SCIENCES AND ENVIRONMENTAL SCIENCES

Feb. 1992 111 p  
(Contract DE-AC03-76SF-00098)  
(DE92-010254; LBL-PUB-696) Avail: NTIS HC/MF A06

The DOE laboratories play a unique role in bringing multidisciplinary talents -- in biology, physics, chemistry, computer sciences, and engineering -- to bear on major problems in the life and environmental sciences. Specifically, the laboratories utilize these talents to fulfill OHER's mission of exploring and mitigating the health and environmental effects of energy use, and of developing health and medical applications of nuclear energy-related phenomena. At Lawrence Berkeley Laboratory (LBL) support of this mission is evident across the spectrum of OHER-sponsored research, especially in the broad areas of genomics; structural biology; basic cell and molecular biology; carcinogenesis; energy and environment; applications to biotechnology; and molecular, nuclear, and radiation medicine. These research areas are briefly described. DOE

N92-26266\*# National Aeronautics and Space Administration, Washington, DC.

### SPACE LIFE SCIENCES STRATEGIC PLAN, 1991

1992 58 p  
(NASA-TM-107856; NAS 1.15:107856) Avail: NTIS HC/MF A04

Over the last three decades the life sciences program has significantly contributed to NASA's manned and unmanned exploration of space, while acquiring new knowledge in the fields of space biology and medicine. The national and international events which have led to the development and revision of NASA strategy will significantly affect the future of life sciences programs both in scope and pace. This document serves as the basis for synthesizing the option to be pursued during the next decade, based on the decisions, evolution, and guiding principles of the National Space Policy. Author

N92-26289# Naval Academy, Annapolis, MD.

### A FRACTAL COMPUTER MODEL OF MACROMOLECULE-CELL SURFACE INTERACTIONS Final Report, 1990-1991

JEFFREY S. DODGE 13 May 1991 83 p  
(AD-A245394; USNA-TSPR-178) Avail: NTIS HC/MF A05

Macromolecules involved in binding to cell surface receptors are important in many biological systems. The cross-linking and clustering of receptors that an antigen can cause is a vital event in the activation of the B-lymphocyte cell and the subsequent initiation of the immune response. This project set out to create a computer model of the interactions between a large molecule with several binding sites, and receptors on the cell surface. In order to have some correlation with a real system, a multivalent antigen and a B-cell were used for physical parameters. The model was designed to provide insight into the behavior of the system, and information on the configurations of bound macromolecules. Analysis of the results from the computer model took two forms: interpretations of the visual output; and numerical analysis of the bound receptor clusters. Fractal geometry was used to characterize the shapes of the cross-linked cell receptors. GRA

N92-26493# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.

### TIME-RESOLVED LASER STUDIES ON THE PROTON PUMP MECHANISM OF BACTERIORHODOPSIN

M. A. EL-SAYED 1991 10 p  
(Contract DE-FG03-88ER-13828)  
(DE92-003218; DOE/ER-13828/4) Avail: NTIS HC/MF A02

Investigations were carried out in four major areas: (1) on the nature of the binding site of  $\text{Eu}(3+)$  in which a fluorescence technique was used to determine the binding equilibrium constant from the concentration of the free  $\text{Eu}(3+)$  in equilibrium with the

bound ions; (2) on the mechanism of the slow deprotonation process of bacteriorhodopsin during its photocycle from the observed temperature and pH dependence of its kinetics; (3) using the circular dichroism spectrum of rB and its perturbed forms to examine the nature of the primary process as well as the origin of the non-exponential kinetic behavior of its photocycle; (4) on bacteriorhodopsin mutants to identify the important amino acids that are part of the reaction coordinate of the deprotonation process as well as to assign the species that are important in giving rise to UV transient absorption whose origin was controversial. Further details of each of these areas are presented. DOE

**N92-26721#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**DIFFERENTIATION ON GENUS OF AQUATIC MACROPHYTES THROUGH REMOTE SENSING IN THE TUCURUI RESERVOIR, PARA STATE, BRAZIL**

MYRIAN DEMOURA ABDON and MARION MEYER (Fundacao de Ciencia, Aplicacoes e Tecnologia Espaciais, Sao Jose dos Campos, Brazil) Aug. 1991 14 p Presented at the 24th International Symposium on Remote Sensing of Environment, Rio de Janeiro, Brazil, 27-31 May 1991; and at the 5th Simposio Latino Americano de Percepcion Remota, Cusco, Peru, 28 Oct. - 1 Nov. 1991

(INPE-5315-PRE/1712) Avail: NTIS HC/MF A03

The purpose of this research is to evaluate the potential of digital data of LANDSAT-TM satellite spectral bands for detecting areas covered by several genus of aquatic macrophytes in the Tucurui Reservoir. Remote sensing is an adequate technique for studies developed in the Amazonian region, where the Tucurui Reservoir is very large, its aquatic plants communities occupy extensive areas and are of difficult access. Thus, the management of this environment becomes possible, as for instance, monitoring hosts of endemic diseases, which live between the roots of aquatic vegetation. For this reason, it used an image of July 16th, 1989, and simultaneous observations were done in field work to verify the occurrence and localization of floating aquatic plants in the Tucurui Reservoir. Histograms acquired from spectral attributes in bands 2, 3, 4, 5 and 7 were analyzed. A vegetation index was done in areas of the reservoir which were occupied by different aquatic macrophytes. Spectral attributes in bands 2 and 7 were selected as those ones that offered better separability between areas occupied by genus *Salvinia* sp, *Scirpus* sp, *Pistia* sp and by several genus of aquatic plants. A supervised classification of the area was done. The spectral attribute in band 5 was added to the supervised classification in order to reduce the confusion between the targets nondense terrestrial vegetation and floating vegetation. Band 5 better separates flooded from nonflooded areas, contributing additionally to distinguishing areas with *Scirpus* sp from areas with *Salvinia* sp. The results of the supervised classification are presented on a map on the scale of 1:250.000.

Author

**N92-26850#** Federal Coordinating Council for Science, Engineering and Technology, Washington, DC. Committee on Life Sciences and Health.

**BIOTECHNOLOGY FOR THE 21ST CENTURY, FY 1993**

Feb. 1992 125 p

(DE92-007757; DOE-92007757) Avail: NTIS HC/MF A06

This report outlines the Federal role in biotechnology research and describes the foundation for a coordinated national initiative that will, over the coming years, maximize the effectiveness of the Federal investment in biotechnology research. Specifically, this report discusses the following topics: (1) the baseline of programmatic activity and Federal funding in biotechnology research; (2) ongoing agency programs and new initiatives; (3) national strategic objectives for biotechnology research; (4) the first interagency Federal biotechnology research budget; and (5) suggests directions for future efforts. The following Biotechnology Research Areas are discussed: Agriculture, Energy, Environment, Health, Manufacturing/Bioprocessing, General Foundations, Genome Projects, Marine Biotechnology, Structural Biology, Social Impact Research, and Infrastructure. DOE

**N92-26938#** Wisconsin Univ., Madison.

**CARBON MONOXIDE METABOLISM BY THE PHOTOSYNTHETIC BACTERIUM RHODOSPIRILLUM RUBRUM**

P. W. LUDDEN and G. P. ROBERTS 1991 5 p

(Contract DE-FG02-87ER-13691)

(DE92-010953; DOE/ER-13691/T2) Avail: NTIS HC/MF A01

Carbon monoxide metabolism in the *Rhodospirillum rubrum* is investigated. In the past year, progress was made in four areas: (1) the identification and isolation of the physiological electron carrier from monoxide dehydrogenase (CODH) to hydrogenase in *R. rubrum*; (2) the isolation, sequencing, and mutagenesis of the genes encoding the components of the CO oxidation system in *R. rubrum*; (3) the purification and characterization of the CO-induced hydrogenase activity of *R. rubrum*; and (4) the spectroscopic investigation of the cobalt-substituted form of the enzyme. DOE

**N92-26977#** Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Lab. of Genetics and Biotechnology.

**THIOCAPSA ROSEOPERSICINA, A BACTERIUM FOR SULFUR-RECYCLING IN MICROBIAL ECOSYSTEMS DESIGNED FOR CELSS AND SPACE PURPOSES**

P. JANSEN and M. MERGEAY *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 799-803 Dec. 1991 Sponsored by Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture and ESA/ESTEC

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

*Thiocapsa roseopersicina*, an anoxygenic phototrophic bacterium, is used to oxidize/recycle reduced sulfur compounds and to consume degradation products, which are produced in the Microbial Ecological Life Support System Alternative (MELISSA) model (waste recycling and biomass production model). MELISSA is an early, simplified model of a Controlled Ecological Life Support System (CELSS). The tests, which were performed at laboratory scale in batch processes, investigate the different growth conditions and degradation efficiencies of the microorganism for acids and reduced sulfur compounds. The obtained results show the versatility of *T. roseopersicina* and its interesting potential for use in space projects. The bacterium is able to grow in the dark, in the light, under microaerophilic and anaerobic conditions, under autotrophy and is able to use sulfide, acetate, lactate, ethanol and urea. The results were found by measuring chemical parameters and by evaluating the optical density (660 nm) of the culture in the medium. ESA

**N92-26978#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Thermal Control and Life Support Div.

**HIGHER PLANT GROWTH IN CLOSED ENVIRONMENT:**

**PRELIMINARY EXPERIMENTS IN LIFE SUPPORT FACILITY AT ESA-ESTEC**

CHRISTIAN TAMPONNET, ROGER BINOT, and DANIEL DECHAMBURE *In its* 4th European Symposium on Space Environmental Control Systems, Volume 2 p 805-810 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The air loop bench of the Environmental Control and Life Support (ECLS) unit of the mechanical systems laboratory at ESTEC was adapted to the culture of plants. CO<sub>2</sub> consumption, O<sub>2</sub> production, water and air contaminants release were measured and/or controlled during the growth cycle of the chosen plant: *Raphanus sativus* L. After 28 days of continuous growth under low light intensity (15 W/sq m) 2.191 g of fresh biomass were obtained (yield of 2.98 kg /sq m) comprising 368 g of radishes (roots), i.e., a harvest ratio of 0.168 if the roots are considered as the only edible part. The main gaseous contaminant was nitrous oxide (N<sub>2</sub>O, up to 170 ppm) and was mainly produced by the plant itself. Transpiration water was considered hygienic but not potable because of its higher than maximum allowable concentration total organic carbon content. These results validated

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the adapted air loop as a potential tool to study the higher plant compartment of CELSS (Controlled Ecological Life Support Systems).  
ESA

**N92-26979#** Academy of Sciences (USSR), Krasnoyarsk. Inst. of Biophysics.

### **CHEMOLITHOTROPIC HYDROGEN-OXIDIZING BACTERIA AND THEIR POSSIBLE FUNCTIONS IN CLOSED ECOLOGICAL LIFE-SUPPORT SYSTEMS**

T. G. VOLOVA, J. G. GITELSON, F. Y. SIDKO, and I. N. TRUBACHEV /in ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 811-815 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Results of experimental studies of chemolithotrophic hydrogen oxidizing bacteria (hydrogen bacteria and carboxidotrophic bacteria) are surveyed. The data on growth and nutrition physiology of these microorganisms and physiological characteristics, correlated with the growth conditions, are given. Prospects to apply chemolithotrophs as producers of biosynthesis target products and as a feasible link in a closed human life support system are discussed. The prospects of applying the culture of *Alkaligenes eutrophus* hydrogen bacteria to perform a number of basic functions of a regeneration component in a closed life support system are analyzed. These functions include: the utilization of the carbonic acid exhaled by man; the reclamation of water and utilization of human exometabolites; and the reclamation of the nutrient substances, mainly the protein component of the diet. ESA

**N92-26982#** MATRA Espace, Paris-Velizy (France). Applications de la Microgravite.

### **MODELLING LIGHT TRANSFER INSIDE PHOTOBIOFERMENTORS: APPLICATIONS TO THE PHOTOSYNTHETIC COMPARTMENTS OF CELSS**

J. F. CORNET, C. G. DUSSAP, G. DUBERTRET, and J. B. GROS (Clermont-Ferrand Univ., France) /in ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 831-836 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The application of light transfer modeling to the photosynthetic compartments of Closed Ecological Life Support System (CELSS) is addressed. The study of interactions between physical limitation by light and biological limitations in photobioreactors leads to very complex partial differential equations. Modeling of radiant energy absorbed in photoreactors requires an equation including two parameters for light absorption and scattering in the culture medium. A simple model based on the simplified, monodimensional equation of Schuster for radiative transfer is discussed. This approach provides a simple way to determine a working illuminated volume in which growth occurs. The analysis is extended to more complex geometries such as cylindrical reactors. ESA

**N92-27120\*#** Park (George W.) Seed Co., Inc., Greenwood, SC.

### **SEEDS IN SPACE EXPERIMENT**

JIM A. ALSTON /in NASA, Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1625-1634 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

Two million seeds of 120 different varieties representing 106 species, 97 genera, and 55 plant families were flown aboard the Long Duration Exposure Facility (LDEF). The seeds were housed in one sealed canister and in two small vented canisters. After being returned to earth, the seeds were germinated and the germination rates and development of the resulting plants were compared to the performance of the control seeds that stayed in the Park Seed's seed storage facility. There was a better survival rate in the sealed canister in space than at the storage facility at Park Seed. At least some of the seeds in each of the vented canisters survived the exposure to vacuum for almost six years.

The number of observed apparent mutations was very low.

Author

**N92-27121\*#** Oklahoma State Univ., Stillwater.

### **SPACE EXPOSED EXPERIMENT DEVELOPED FOR STUDENTS (SEEDS) (P0004-2)**

DORIS K. GRIGSBY and NELSON J. EHRlich /in NASA, Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1635-1636 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

SEEDS, a cooperative endeavor of NASA Headquarters, the NASA Langley Research Center, and the George W. Park Seed Company, resulted in the distribution of approximately 132,000 SEEDS kits to 3.3 million students. Kits contained Rutgers tomato seeds that had flown on the Long Duration Exposure Facility (LDEF), as well as seeds that had been stored in a climate controlled warehouse for the same time period. Preliminary data indicates the germination rate for space exposed seeds was 73.8 percent while Earth based seeds germinated at a rate of 70.3 percent. Tests conducted within the first six months after retrieval indicated space exposed seeds germinated in an average of 8.0 days, while Earth based seeds' average germination time was 8.3 days. Some mutations (assumed to be radiation induced) include plants that added a leaf instead of the usual flower at the end of the flower frond. Also, fruit produced from a flower with a variegated calyx bore seeds producing albino plants, while fruit from a flower with a green calyx from the same plant bore seeds producing green plants. Author

**N92-27122\*#** The Research Inst. of the Gulf of Maine, South Portland.

### **SURVIVAL OF EPIPHYTIC BACTERIA FROM SEED STORED ON THE LONG DURATION EXPOSURE FACILITY (LDEF)**

#### **Abstract Only**

ANDREW C. SCHUERGER, BRET L. NORMAN, and JOSEPH A. ANGELO, JR. (Science Applications International Corp., Melbourne, FL) /in NASA, Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1637 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

Microbial contamination in American spacecraft has previously been documented, however, potential risks to plants and humans in future space based controlled ecological life support systems (CELSS) have yet to be addressed directly. The current study was designed to determine the survival of microorganisms exposed to the relatively harsh conditions found in low Earth orbit (LEO). Total mean dosage for flight and ground control seeds were 210.2 and 0.9 rads, respectively. Bacteria were isolated by plating samples of seed washings onto dilute tryptic soy agar. Pure isolates of morphologically distinct bacteria were obtained by standard microbiological procedures. Bacteria were grouped according to colony type and preliminary identification was completed using a fatty acid analysis system. *Bacillus* spp. were the primary microorganisms that survived on seed during the experiment. Results support the hypothesis that terrestrial microorganisms can survive long periods of time in relatively harsh LEO environments. Author

**N92-27123\*#** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

### **PRELIMINARY TOTAL DOSE MEASUREMENTS ON LDEF**

G. REITZ /in NASA, Langley Research Center, LDEF: 69 months in Space. First Post-Retrieval Symposium, Part 3 p1643-1649 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

After spending nearly six years in Earth's orbit twenty stacks consisting of radiation detectors and biological objects are now back on Earth. These Free Flyer Biostack experiments are part of the Long Duration Exposure Facility (LDEF). The major objective of the experiments are to investigate the biological effectiveness of single heavy ions of the cosmic radiation in various biological systems and to provide information about the spectral composition

of the radiation field and the total dose received in the LDEF orbit. The preliminary analysis of the thermoluminescence dosimeters (TLD) yields maximum absorbed dose rates of 2.24 mGy day(exp -1) behind 0.7 g cm(exp -2) shielding and 1.17 mGy day(exp -1) behind 12 g cm(exp -2) shielding. A thermal neutron fluence of 1.7 n cm(exp -2)s(exp -1) is determined from the differences in absorbed dose for different isotopic mixtures of lithium. The results of this experiment on LDEF are especially valuable since LDEF stayed for almost six years in the prospected orbit of the Space Station Freedom. Author

**N92-27124\*#** Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (Germany, F.R.). Botanical Inst.

**TOTAL DOSE EFFECTS (TDE) OF HEAVY IONIZING RADIATION IN FUNGUS SPORES AND PLANT SEEDS: PRELIMINARY INVESTIGATIONS**

A. R. KRANZ, M. W. ZIMMERMANN, R. STADLER, K. E. GARTENBACH, and M. PICKERT /in NASA. Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1651-1660 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

The opportunity to compare cosmic radiation effects caused during long and short duration exposure flights in biological objects are limited until now, and data obtained so far are very rare and insufficient. Because of the very long exposure of the experiment during the Long Duration Exposure Facility (LDEF) mission (approximately 2000 days) structural changes of the hardware material can be expected which will influence its biocompatibility and, thus, will interact with the radiobiological effects. The aim of the experiment flown on LDEF was a detailed investigation of biological effects caused by cosmic radiation especially of particles of high atomic number Z and high energy. The flight hardware consisted of standard BIOSTACK containers; in these containers a special sandwich construction consisted of visual plastic detectors with seed spore layers interlocked. H.A.

**N92-27125\*#** Marburg Univ. (Germany, F.R.). Dept. of Environmental Sciences and Space Medicine.

**PRELIMINARY RESULTS OF THE ARTEMIA SALINA EXPERIMENTS IN BIOSTACK ON LDEF**

E. H. GRAUL, W. RUETHER, and C. O. HIENDL /in NASA. Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1661-1665 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

The mosaic egg of the brine shrimp, *Artemia salina*, resting in blastula or gastrula state represents a system that during further development, proceeds without any further development to the larval stage, the free swimming nauplius. Therefore, injury to a single cell of the egg will be manifest in the larvae. In several experiments, it was shown that the passage of a single heavy ion through the shrimp egg damaged a cellular area large enough to disturb either embryogenesis or further development of the larvae, or the integrity of the adult individual. Emergence from the egg shell was heavily disturbed by the heavy ions as was hatching. Additional late effects, due to a hit by a heavy ion, are delayed of growth and of sexual maturity, and reduced fertility. Anomalies in the body and the extremities could be observed more frequently for the nauplii which had developed from eggs hit by heavy ions. H.A.

**N92-27126\*#** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. of Aerospace Medicine.

**LONG-TERM EXPOSURE OF BACTERIAL SPORES TO SPACE**  
G. HORNECK, H. BUECKER, and G. REITZ /in NASA. Langley Research Center, LDEF: 69 Months in Space. First Post-Retrieval Symposium, Part 3 p 1667-1673 Jan. 1992

Avail: NTIS HC/MF A21; 1 functional color page

With the NASA mission of the Long Duration Exposure Facility (LDEF), the authors have obtained the opportunity to expose *Bacillus subtilis* spores for nearly six years to the space environment and to analyze their responses after retrieval. The experiment was mounted onto a side tray of LDEF facing space. Data shows

that the chances of microorganisms surviving in free space will be greatly increased by adequate shielding against solar ultraviolet light. H.A.

**N92-27322\*#** Oklahoma State Univ., Stillwater.

**FINAL RESULTS OF THE SPACE EXPOSED EXPERIMENT DEVELOPED FOR STUDENTS (SEEDS) P-0004-2 Abstract Only**

DORIS K. GRIGSBY /in NASA. Langley Research Center, Second LDEF Post-Retrieval Symposium Abstracts p 121 Jun. 1992  
Avail: NTIS HC/MF A07

Space Exposed Experiment Developed for Students (SEEDS), resulted in the distribution of over 132,000 SEED kits in 1990. The kits contained Rutgers' tomato seeds that had flown on the Long Duration Exposure Facility (LDEF) as well as seeds that had been stored in a climate controlled warehouse for the same period of time. Students compared germination and growth rate characteristics of the two seeds groups and returned data to NASA for analysis. The scientific information gained was valuable as students shared the excitement of taking part in a national project. Of greater importance was the subsequent interest generated in science education. Author

**N92-27323\*#** Park Seed Co., Inc., Greenwood, SC.

**CONTINUED RESULTS OF THE SEEDS IN SPACE EXPERIMENT Abstract Only**

JIM A. ALSTON /in NASA. Langley Research Center, Second LDEF Post-Retrieval Symposium Abstracts p 122 Jun. 1992  
Avail: NTIS HC/MF A07

Two million seeds of 120 different varieties representing 106 species, 97 genera, and 55 plant families were flown aboard the Long Duration Exposure Facility (LDEF). The seeds were housed on the Space Exposed Experiment Developed for Students (SEEDS) tray in the sealed canister number 6 and in two small vented canisters. The seeds were germinated and the germination rates and development of the resulting plants compared to the control seed that stayed in the storage facility. There was a better survival rate in the sealed canister in space than in the storage facility. At least some of the seed in the vented canisters survived the exposure to vacuum for almost six years. The number of observed mutations was very low. In the initial testing, the small seeded crops were not grown to maturity to check for mutation and obtain a second generation seed. These small seeded crops are now being grown for evaluation. Author

**N92-27877\*#** Bionetics Corp., Cocoa Beach, FL.

**A SUMMARY OF POROUS TUBE PLANT NUTRIENT DELIVERY SYSTEM INVESTIGATIONS FROM 1985 TO 1991**

T. W. DRESCHER, C. S. BROWN, W. C. PIASTUCH, C. R. HINKLE, J. C. SAGER, R. M. WHEELER, and W. M. KNOTT Jan. 1992  
37 p

(Contract NAS10-10285; NAS10-11624)

(NASA-TM-107546; NAS 1.15:107546) Avail: NTIS HC/MF A03

The Controlled Ecological Life Support System (CELSS) Program is a research effort to evaluate biological processes at a one person scale to provide air, water, and food for humans in closed environments for space habitation. This program focuses currently on the use of conventional crop plants and the use of hydroponic systems to grow them. Because conventional hydroponic systems are dependent on gravity to conduct solution flow, they cannot be used in the microgravity of space. Thus, there is a need for a system that will deliver water and nutrients to plant roots under microgravity conditions. The Plant Space Biology Program is interested in investigating the effect that the space environment has on the growth and development of plants. Thus, there is also a need to have a standard nutrient delivery method for growing plants in space for research into plant responses to microgravity. The Porous Tube Plant Nutrient Delivery System (PTPNDs) utilizes a hydrophilic, microporous material to control water and nutrient delivery to plant roots. It has been designed and analyzed to support plant growth independent of gravity and plans are progressing to test it in microgravity. It has been used successfully to grow food crops to maturity in an

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earth-bound laboratory. This document includes a bibliography and summary reports from the growth trials performed utilizing the PTPNDS. Author

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

**A92-42698**

**HYPERBARIC OXYGENATION IN THE COMPLEX OF REHABILITATION MEASURES APPLIED TO SAILORS AFTER A LONG SEA VOYAGE [GIPERBARICHESKAIA OKSIGENATSIIA V KOMPLEKSE REABILITATSIONNYKH MEROPRIIATII MORIAKOV POSLE DLITEL'NOGO PLAVANIIA NA MORSKIKH SUDAKH]**

V. V. DOVGUSHA and T. A. PAVLOVA (NII Gigieny Morskogo Transporta, St. Petersburg, Russia) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 37, no. 6, Nov.-Dec. 1991, p. 78-84. In Russian. refs

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The effect of the administration of a hyperbaric oxygenation (HBO) procedure on the progress of rehabilitation of sailors after their return from a long sea voyage was investigated by measuring physiological parameters of the cardiovascular system in subjects who received only HBO treatment for 5 or 10 days or HBO combined with a balneologic procedure (Finnish baths) or a vitamin complex. It was found that 10 sessions of HBO combined with Finnish baths were sufficient to stimulate the redox processes in sailors transferred to a new functional level due to their return to land life. I.S.

**A92-42699**

**A METHOD FOR DETERMINING THE FUNCTIONAL STATE OF RESPIRATION AND CIRCULATION SYSTEMS IN HUMANS UNDERGOING SUBMERSION [METODIKA OPREDELENNIA FUNKSIONAL'NOGO SOSTOIANIIA SISTEM DYKHANIIA I KROVOBRASHCHENIIA CHELOVEKA V PODVODNYKH USLOVIIAKH]**

E. V. MOISEENKO and V. P. FEDORCHENKO (AN Ukrainy, Institut Fiziologii, Kiev, Ukraine) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 37, no. 6, Nov.-Dec. 1991, p. 100-106. In Russian. refs

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A device was designed for registering the parameters of respiration, gas exchange, and circulation in humans undergoing submersion and performing several tests (graduated exercises and respiration with changed gas mixture) under water. The correction coefficients were experimentally determined to calculate gas-exchange and cardiohemodynamics indices under these conditions. A schematic diagram of the device is presented. I.S.

**A92-42779**

**RESPIRATION AND WORK CAPACITY OF HUMANS AT HIGH ALTITUDES (PHYSIOLOGICAL EFFECTS OF HIGH-ALTITUDE HYPOXIA AND HYPOCAPNIA) [DYKHANIE I RABOTOSPOSOBNOST' CHELOVEKA V GORNYYKH USLOVIIAKH /FIZIOLOGICHESKIE EFFEKTY VYSOTNOI GIPOKSII I GIPOKAPNII/]**

ISAAK S. BRESLAV and ALEKSANDR S. IVANOV Alma-Ata, Kazakh SSR, Izdatel'stvo Gylm, 1990, 183 p. In Russian. refs (ISBN 5-628-00579-7) Copyright

The book discusses contemporary concepts of respiration control and investigates factors which affect respiration and related physiological functions (such as work capacity) of humans residing at high altitude. Consideration is given to the role of hypocapnia, negative or adaptive; the work capacity at high altitudes and the responses of the respiratory system to the physical workload at

high altitudes; and the processes of acclimatization to high altitude and reacclimatization and their effects on work capacity. Special attention is given to the use of high-altitude training of athletes for competitions in lowlands. I.S.

**A92-43006**

**DYNAMIC CHANGES IN BODY SURFACE TEMPERATURE AND HEART RATE RHYTHM DURING BED-REST**

JINHE WEI, GUNGDONG YAN, ZHIQIANG GUAN, XIANYUN SHEN, and YAZHI SUN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 1-10. refs

Dynamic changes of diurnal and ultradiurnal rhythms during simulated weightlessness were investigated by observing changes of body surface temperature (BST) and heart rate (HR) during 24 hrs at the beginning, middle, and end of 125 days of bedrest, respectively. It was found that, in addition to the circadian rhythm, the 1.09-1.33 hr rhythm complex in BST and the 3.4 hr rhythm in HR appeared. The power of some typical rhythms in BST and HR and the synchronousness of BST circadian rhythms recorded on the second day of bedrest were significantly less than those recorded on the 7th and/or the 14th day. The results suggest that to some extent disorders of the BST and HR rhythm are induced at least on the second day of bedrest and recovery occurs between the 7th and 14th day. C.D.

**A92-43007**

**INTERACTION OF OPTOKINETIC STIMULI AND HEAD MOVEMENTS ON MOTION SICKNESS AND ANALYSIS OF ITS MECHANISM**

TIANDE YANG and JINGSHEN PEI (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 11-18. In Chinese. refs

A total of 16 male and 10 female subjects were tested in a rotating sphere at a speed of 7.5 r/min and exposed to optokinetic simulation (OS) of pitch, roll, or yaw. Yaw vection induced by yaw-OS was the strongest illusory sensation of self-rotation, followed by roll vection induced by roll-OS, and finally pitch vection by pitch-OS. This was mainly due to resistance of utricle otoliths to roll vection and the resistance of utricle and saccule otoliths to pitch vection. The different resistances of otoliths sent messages that conflicted with visual signals under different OS; thus, pitch-OS was the most stressful in inducing motion sickness (MS), roll-OS was second, and yaw-OS third. Strong combinations of OS and head movements significantly enhanced MS, while weak combinations significantly suppressed MS. Pseudo-Coriolis effect caused severe conflict between the visual and vestibular systems and combined with head movement strongly enhanced MS. C.D.

**A92-43011**

**THE GRAY LEVEL RESOLUTION AND INTRINSIC NOISE OF HUMAN VISION**

WEIXIN XIE and AN QIN (Xidian Electronics University, Xian, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 51-55. In Chinese. refs

A group of physiological experiments was designed to study the gray level resolution ability of human vision in black-white and three primary colors under normal indoor illumination. A gray level resolution model of human eyes was developed and a quantitative result is presented. It was found that there was no obvious difference in the visual resolution of black-white and three primary colors when a subject observed a monitor screen under normal indoor illumination. In an image system displaying from 0 to 255 gray levels, the correct resolving power of gray levels 8, 16, and 32 was about 93.16, 68.75, and 45.31 percent, respectively. An equivalent intrinsic noise model of human vision was proposed which is Gaussian white noise with a mean of 0 and a variance of 64. The results from the model correspond to those of physiological experiments. It is concluded that two gray levels, full

black and white, should be used as brightness symbols in man-machine vision communication. The number of gray levels should not be more than four. C.D.

**A92-43014****WOMEN AND ALTITUDE DECOMPRESSION SICKNESS**

MIN ZHAO (Medical University No. 4, Xian, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 71-73. In Chinese. refs

The incidence of high-altitude decompression sickness among females is evaluated, and compared with that of males. Therapy responses for males and females are reported. Y.P.Q.

**A92-43015****DEPRESSION SYNDROME CAUSED BY EXPOSURE TO ADVERSE ENVIRONMENTAL FACTORS**

RUI-JUN ZHANG, GUANG-HUA YANG, and JIN-KANG QIAN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 79-84. refs

A syndrome constituting a reaction pattern different from Selye's stress reaction has been investigated in human subjects and mice over the last 10 yrs. The reaction pattern is to long-term exposure to microwave irradiation, high concentration of CO<sub>2</sub>, noise, and drugs. The typical manifestations of the reaction were a general depression of bodily functions, including asthenic changes, depression of immune functions and hematopoiesis, and disturbance of serotonin secretion in certain organs. Glucocorticoid secretion was lowered significantly, in contrast to the Selye reaction in which it is increased. C.D.

**A92-43017****SYSTEMS INVESTIGATION ON SELF-ADAPTATION CHARACTERISTICS OF HUMAN BODY SYSTEM DURING HEAD DOWN TILT BED REST**

HE-FENG YU, XIAOXIA YAN, LIHUA XU, and JIANPING WU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 91-99. In Chinese. refs

Eight to 23-day bedrest tests with head-down tilt of 0-6 deg were performed in 40 healthy young men, and 12-28 physiological and biochemical parameters were observed and analyzed before, during, and after bed rest using macrointegral system analysis. For every subject, all of the original observed parameters were replaced by 2-4 comprehensive parameters. The locations and traces of physiological functional state points were found to reflect the whole-body system functional state in the 2D-4D system phasic space formed by these comprehensive parameters. The system structural characteristics of self-organization and self-adaptation of various individual body systems during bedrest tests could be understood from the main physiological meanings of the comprehensive parameters. C.D.

**A92-43020****CORRELATION BETWEEN ANAEROBIC THRESHOLD TEST AND CARDIOVASCULAR COMPENSATION IN HYPOXIA**

LI-MIN ZHANG, HONGZHANG GUO, MEIRONG CHEN, YAFEN ZHU, and BAISHENG JING (Air Force, Institute of Aviation Medicine, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 116-122. In Chinese. refs

The correlation between the score of the anaerobic threshold (AT) and cardiovascular (CV) compensation was studied in 17 healthy young men. The AT scores were determined by finding the break point of the systematic increase in  $V\text{-dot}(E)/V\text{-dot}(O_2)$  without a concomitant increase in  $V\text{-dot}(E)/V\text{-dot}(CO_2)$  during incremental exercise on an ergometer. The CV compensation for hypoxia at simulated altitude of 5000 m by inhalation of hypoxic air for 30 min was evaluated. The correlation coefficient between AT and the compensatory score of the CV system was  $r = 0.78$ . The AT score of the group above 'fair' in CV compensation was much higher than that of the group called 'poor' in CV

compensation. The CV compensation in hypoxia could be fairly well predicted using AT. It can be used as an index in laboratory or field work. C.D.

**A92-43021****DYNAMIC RESPONSE OF THORAX AND ABDOMEN TO WINDBLAST**

YUY-YING TENG, GUANGXING YOU, GUIHUA DONG, YUNRAN ZHANG, and HUAZHONG LIN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 123-130. In Chinese. refs

The dynamic response of animal thoraxes and abdomens to simulated windblast during emergency ejection from aircraft was investigated. Nine pigs, five dogs, and six monkeys were subjected to dynamic pressures  $q(c)$  of 47.1 to 81.4 kPa. The severity of injuries was quantified using the Abbreviated Injury Scale (AIS). Results showed that, within the observed range of  $q(c)$ , thoracic and abdominal injuries in pigs were AIS 4 or AIS 5, those in monkeys were AIS 0 or 1, and those in dogs were AIS 1 to 3. Peak deflections of the chest and thoracic compressions increased with  $q(c)$ . The thoracic compressions reached 34.9 to 57.0 percent. There were multiple rib fractures in most of the pigs, while no fractures were observed in dogs and monkeys. When animals were ejected into the air flow, their intrathoracic pressures and intraabdominal pressures rose rapidly, but correlations with  $q(c)$  were insignificant. C.D.

**A92-43022****DISTRIBUTION AND VARIATION OF THE SKIN TEMPERATURE AND HEAT DISSIPATION OVER HUMAN HEAD AND NECK AT DIFFERENT AMBIENT TEMPERATURES**

HAO-QIN XIAO, DINGLIANG GU, JIANMIN WU, and CHENG PANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 131-135. In Chinese. refs

Distributions of the skin temperature and heat dissipation rate over the human head and neck at five different ambient temperatures were observed and the relationship between them was studied. It is found that the distribution of skin heat dissipation was not completely consistent with that of skin temperature due to differences of configuration and anatomic constitutions among the various sites and the different effects of ambient conditions at those sites. It is further demonstrated that sites over the head and neck can be divided into constantly high or constantly low heat dissipation areas and nonconstant heat dissipation areas according to the level of total heat dissipation rate when the evaporative heat dissipation is considered. The results have reference value in the design of personal protective equipment. C.D.

**A92-43023****DYNAMIC RESPONSE OF HUMAN BODY UNDER RANDOM VIBRATION IN DIFFERENT DIRECTIONS**

FANG-ZI WANG, YUXIA XUAN, ZHI WANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China), SHILIANG DAI, and CHUNLIANG JI (Tsinghua University, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 136-144. In Chinese. refs

Fifty-three subjects were exposed to random vibrations in the x, y, and z directions while in the sitting position. The human dynamic responses and the effects of restraining belts and various vibration magnitudes were studied. The accelerations of the head, shoulder, chest, abdomen, and iliac ridge were measured for each subject. The results showed that the responses curves of all the subjects in the same direction were substantially the same. The resonance frequencies decreased with increasing G levels of vibration. The nonlinear reactions of the subjects were obvious. A main resonance was observed at the iliac ridge under vibrations of about 100 Hz in the y axis. C.D.

A92-43024

**STUDY OF THE INCREASE OF WORK CAPACITY AT HIGH ALTITUDE WITH HIGH ENERGY MIXTURE**

ZHAO-YUN YIN, JUNPING JIU, YINZHI XIE, and YONGDA LU (Academy of Military Medical Science, Institute of Hygiene and Environmental Medicine, Tianjin, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 145-150. In Chinese. refs

The effects of a high-energy food mixture on exercise performance in mice, rats, and humans during hypoxia were investigated. The mice and rats were forced to swim in a hypobaric chamber at simulated altitudes of 10,000 m and 5000 m, respectively, while the humans pedaled a bicycle ergometer with increasing load. The results showed that survival time in the animal test and control subjects were 71.8 +/- 3.0 min and 59.3 +/- 3.1, respectively, and the levels of blood glucose, glycogen, and ATP in skeletal muscle in the test animals were significantly higher than those in the control groups. The RCR or ADP/O of mitochondria were also higher in the test groups than in the control groups. The anaerobic thresholds of human subjects, as determined by gas exchanges, were 16.0 percent more in test groups than in control groups during a one-week sojourn at an altitude of 4370 m. These data indicate that the high-energy food mixtures might play an important role in improving work capacities at high altitudes. C.D.

A92-43030

**EVALUATION OF SOMATIC EIGENSTATE UNDER COMBINED HYPOXIA, HEAT, NOISE AND VIBRATION**

XUE-JUN YU, SIGUANG JIA, and JINGSHEN CHEN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 185-192. In Chinese. refs

Twenty four young men were exposed to hypoxia, heat, vibration, and noise. Measurements were made of respiration, circulation EEG, performance, auditory temporary threshold shift, body temperature, symptoms, and signs. Expert evaluation principle was introduced as one of the criteria for the classification of the state of each measurement (comfort, performance, safety, and tolerable limit), which was carried out using statistical analysis in combination with the magnitude estimation of certain physiological reactions. The most serious state of measurements of every system was chosen as the somatic eigenstate in the test. Author

A92-43034

**THE EFFECT OF HIGH TEMPERATURE ON TOLERANCE TO POSITIVE ACCELERATION AND ITS COMBINED COUNTERMEASURES**

CHENG PANG Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 3, Sept. 30, 1991, p. 221-226. In Chinese. refs

Analysis of acceleration tolerance reduction under high temperature is presented. Ways to prevent such reduction under high temperature are discussed. The effects of minimal dehydration on human tolerance to positive acceleration are addressed. Y.P.Q.

A92-43036

**THE CHANGES OF SURFACE TEMPERATURES OF VARIOUS REGIONS OF THE BODY UNDER DIFFERENT AMBIENT TEMPERATURES AND WORK LOADS**

CHENG PANG, DINGLIANG GU, JIANMIN WU, XIANZHANG WANG, and XUEBIN YU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 245-252. In Chinese. refs

Results are presented of an investigation of surface temperatures of various parts of the body under different ambient temperatures during rest and under work loads with the same ambient temperatures. Skin temperatures of the forehead, temporal, zygomatic, neck, chest, back, arm, and thigh regions, and rectal temperature were measured. It was proved that the distribution of the surface temperature in the head-neck region under the same

ambient temperature is nonuniform, as are the degrees of the effect of the ambient temperature on skin temperatures of the various portions in this region. Changes in skin temperature in the head-neck region and other parts of the body are not particularly related to work-load intensity. The cause of this phenomenon is discussed and analyzed. P.D.

A92-43037

**EFFECT OF ASSISTED POSITIVE PRESSURE BREATHING (APPB) COMBINED WITH ANTI-G STRAINING MANEUVER ON G TOLERANCE**

QI-YU GUO and PING YU (Air Force, Institute of Aviation Medicine, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 253-258. In Chinese. refs

The paper evaluates APPB and the L-1 maneuver on G tolerance, and addresses the possibility and anti-G effect of APPB combined with the anti-G suit (AGS) and L-1 maneuver in order to provide physiological experimental evidence for the new anti-G system in future high-performance fighting aircraft. It is shown that APPB5.98 was more suitable in increasing pilots' +Gz tolerance as compared with APPB1.99, APPB3.99, and APPB7.99. The increase of +Gz tolerance by APPB5.98 and by APPB5.98 + AGS was 1.75 and 3.25 G, respectively. BP was lower and CO was less in APPB5.98 as compared with those in the L-1 maneuver; however, APPB5.98 was less fatiguing and easier to master. The combination of APPB5.98 with the L-1 maneuver was not only possible but also very effective. P.D.

A92-43038

**INVESTIGATION OF DYNAMIC CHARACTERISTICS OF MAIN PHYSIOLOGICAL PARAMETERS DURING BED REST TEST**

XIAO-XIA YAN, HEZHEN YU, ZHENXIU LIU, YUHUA YANG, XIURONG WANG, and JIANPING WU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 259-267. In Chinese. refs

Six healthy male volunteers aged 19-21 were selected as test subjects. The schedule of experiments included a 3-day control period (pre-HDT), a 8-day bed rest period with head down tilt of -6 deg (HDT) and a 5-day recovery period (post-HDT). Physiological parameters (SV, CO, HR, BP, TFI, EVI, LVET) were measured four times, and norepinephrine (NE), epinephrine (E), potassium (K(+)), sodium (Na(+)), and cortisol excretion in urine were assayed six times daily in the experiment. The results indicated that SV, CO, pulse pressure, and NE excretion decreased significantly, and peripheral resistance, K(+), Na(+), and cortisol excretions increased markedly during HDT. Circadian rhythmic changes of the cardiovascular and biochemical parameters were also observed. The fact that there was a positive correlation with medium significance between cardiac output and NE reflects that NE might play an important role in the control of CO during bed rest. Author

A92-43040

**GRADUATION OF THERMAL STATE OF THE BODY AND ITS USE IN THE EVALUATION OF PERSONAL HEAT PROTECTIVE EQUIPMENTS**

DAI-XIO CUEI and XIANZHANG WANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 283-288. In Chinese. refs

The physiological thermal state of the body was graduated onto five stages. They are respectively: thermal comfort state, warm state, and the light, middle, and heavy heat-load states. Rectal temperature, skin temperature, sweat rate, heart rate, and heat store were used as physiological basis for the evaluation. A complex evaluation index for the above five physiological indices was established by multivariate regression. It is used successfully in the appraisal of personal heat-protective equipments. Author

A92-43041

**HUMAN TOLERANCE TO EJECTION ACCELERATION**

FAN-ZI WANG, YUXIA XUAN, and ZHI WANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 289-295. In Chinese. refs

Utilizing data measured from aircraft seat and the human body during human ejection tests, a human dynamic model was developed with one degree-of-freedom. The reliability of the model prediction was confirmed by repeating human tests. The way of using the model to determine the tolerance of human body to ejection acceleration was discussed. Human tolerance was defined by the injury probability of vertebrae. Limits of human tolerance were determined by combining the dynamic characteristics of the system with the breaking strength of vertebrae. Breaking loads of vertebrae at injury probabilities of 5, 50, and 95 percent were found to be 18.5, 21.5, and 25.7 G, respectively. The maximum overshoot was 50 percent, so the corresponding ejection-acceleration G levels were 12, 14 and 17 G respectively. This model is the same as DRI model but was deduced in a different way.

**A92-43043**  
**IMMUNOLOGICAL PROBLEMS IN MANNED SPACE FLIGHT**

GUANG-HUA YANG Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 300-306. In Chinese. refs

Research on functional changes of the cardiovascular system, vestibular apparatus, and skeletal muscle system are presented. The inhibition effect of the immune function in certain environment is analyzed. Y.P.Q.

**A92-43800\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**TONIC VIBRATION REFLEXES AND BACKGROUND FORCE LEVEL**

JAMES R. LACKNER, PAUL DIZIO (Brandeis University, Waltham, MA), and JOHN FISK (Camp Hill Hospital, Halifax, Canada) Acta Astronautica (ISSN 0094-5765), vol. 26, no. 2, Feb. 1992, p. 133-136. refs  
(Contract NAG9-295)  
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On earth, the functional stretch reflex is an important component in the maintenance of posture and muscle tone. In parabolic flight experiments, it is evaluated whether the functional stretch reflex, as reflected in the tonic vibration reflex, adjusts appropriately for changes in background gravito-inertial force level. Virtually immediate alterations of appropriate sign occurred. Author

**A92-43971**  
**CHANGES OF TEMPERATURE SENSITIVITY IN HUMANS DURING ADAPTATION TO COLD AND HYPOXIA [IZMENENIE TEMPERATURNOI CHUVSTVITEL'NOSTI U CHELOVEKA V PROTSSESSE ADAPTATSII K KHOLODU I GIPOKSII]**

M. I. BOCHAROV and S. I. SOROKO (AN Kyrgyzstana, Institut Fiziologii i Eksperimental'noi Patologii Vysokogor'ia, Bishkek, Kyrgyzstan) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 18, no. 3, May-June 1992, p. 157-161. In Russian. refs  
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Changes of temperature sensitivity in humans during adaptation to the conditions of the Antarctic and the Tien-Shan highlands, and of its dynamics in ontogenesis were investigated using results of the subjects' subjective assessments of the changes under local and general exposures to cold. It is shown that chronic exposures to cold lead to steady increases in the sensitivity to cold, which increases upon combining the cold exposure with exposure to high altitude. It is suggested that the lowering of the threshold of the skin-receptor excitability is an important factor in the mechanism involved in increasing the efficiency of the thermoregulatory system under changing temperature conditions. I.S.

**A92-43972**  
**CIRCADIAN RHYTHMS OF THE PARAMETERS OF THERMAL HOMEOSTASIS IN HEALTHY INDIVIDUALS DURING ACCLIMATIZATION TO ARID CLIMATE [SUTOCHNYE RITMY PARAMETROV TEMPERATURNOGO GOMEOSTAZA U ZDOROVYKH LITS V PROTSSESSE AKKLIMATIZATSII K USLOVIAM ARIDNOI ZONY]**

O. I. FEDOROVA and O. V. FILATOVA (Altaiskii Gosudarstvennyi Universitet, Barnaul, Russia) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 18, no. 3, May-June 1992, p. 162-168. In Russian. refs

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Results are presented of an investigation of biorhythms of the heat-exchange parameters in four subject groups: (1) natives of Central Asia, (2 and 3) individuals who were born and lived in the southwestern (warm) and the northeastern (cold) regions of the Soviet Union, respectively, but who have resided the last three years in Central Asia, and (4 and 5) natives of the southwestern and the northeastern regions who spent only 3-5 days in Central Asia. It was found that, after three years of adaptation to arid climate (groups 2 and 3), healthy individuals acquired the circadian rhythm of heat exchange parameters that was similar to that of aborigenes. I.S.

**A92-44420**  
**JET-LAG SYNDROME - EFFECTS OF RAPID CHANGE OF TIME ZONES [SKUTKI NAGLEJ ZMIANY STREFY CZASU - ZESPOL 'DLUGU CZASOWEGO']**

KRZYSZTOF KWARECKI and KRZYSTYNA ZUZEWICZ (Military Institute of Aviation Medicine, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 5-24. In Polish. refs

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A review paper about cause and physiological mechanism of jet-lag syndrome - functional state of organism after rapid change of time zones is presented. An example of pilot of Polish Air Lines LOT is used for illustration. Disturbances of sleep, gastrointestinal function in flying personnel after changing of time zones and prophylactic procedures against jet-lag are discussed. Author

**A92-44423**  
**TEMPERAMENT, NERVOUSNESS, ANXIETY, AND FEAR EXPERIENCED BY PILOTS WITH HIGH +GZ ACCELERATION TOLERANCE DURING HIGH-ACCELERATION CENTRIFUGE TESTS [TEMPERAMENT, NEUROTYZM, NIEPOKOJ I LEK PILOTOW WYSOKO TOLERUJACYCH PRZYSPIESZENIA +GZ, PODCZAS BADAN NA WIROWCE PRZECIAZENIOWEJ]**

WALDEMAR BULSKI and TADEUSZ JASINSKI (Military Institute of Aviation Medicine, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 41-50. In Polish. refs  
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**A92-44424**  
**USE OF THE LOWER BODY NEGATIVE PRESSURE (LBNP) MODEL FOR ASSESSING DIFFERENCES IN SELECTED HEMODYNAMIC REACTIONS IN PILOTS WITH GOOD AND POOR TOLERANCE TO ACCELERATION IN THE +GZ-AXIS [ZASTOSOWANIE MODELU OBNIZONEGO CISNIENIA WOKOL DOLNEJ POLOWY CIAŁA /LBNP/ DO OCENY ROZNIC REAKCJI HEMODYNAMICZNYCH U PILOTOW DOBRZE I ZLE TOLERUJACYCH PRZECIAZENIA W OSI +GZ]**

MARIUSZ ZEBROWSKI and BRONISLAW TURSKI (Military Institute of Aviation Medicine, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 51-61. In Polish. refs

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A92-44425

**THE EFFECT OF EXERCISES ON SPECIAL AVIATION-GYMNASTIC DEVICES ON THE STATE OF BALANCE ORGANS (WPLYW CWICZEN NA LOTNICZYCH GIMNASTYCZNYCH PRZYRZADACH SPECJALNYCH /LGPS/ NA HABITUACJE NARZADU ROWNOWAGI)**

RYSZARD JEDRYS (Wyzsza Oficerska Szkola Lotnicza, Deblin, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 63-68. In Polish. Copyright

A92-44554\* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**STUDIES OF THE HORIZONTAL VESTIBULO-OCULAR REFLEX IN SPACEFLIGHT**

WILLIAM E. THORNTON (NASA, Johnson Space Center, Houston, TX), JOHN J. URI (General Electric Co., Mission Science Support Office, Houston, TX), TOM MOORE (Methodist Hospital, Indianapolis, IN), and SAM POOL (NASA, Johnson Space Center, Houston, TX) Archives of Otolaryngology - Head & Neck Surgery (ISSN 0886-4470), vol. 115, Aug. 1989, p. 943-949. refs Copyright

Changes in the vestibulo-ocular reflex (VOR) during space flight have been suspected of contributing to space motion sickness. The horizontal VOR was studied in nine subjects on two space shuttle missions. Active unpaced head oscillation at 0.3 Hz was used as the stimulus to examine the gain and phase of the VOR with and without visual input, as well as the visual suppression of the reflex. No statistically significant changes were noted in flight in the gains or phase shifts of the VOR during any test condition, or between space motion sickness susceptible and nonsusceptible populations. Although VOR suppression was unaffected by spaceflight, the space motion sickness-susceptible group tended to exhibit greater error in the suppression than the nonsusceptible group. It is concluded that at this stimulus frequency, VOR gain is unaffected by space-flight, and any minor individual changes do not seem to contribute to space motion sickness. Author

A92-44632

**USE OF BIOELECTRICAL IMPEDANCE TO ASSESS BODY COMPOSITION CHANGES AT HIGH ALTITUDE**

CHARLES S. FULCO, REED W. HOYT, CAROL J. BAKER-FULCO, JULIO GONZALEZ, and ALLEN CYMERMAN (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Journal of Applied Physiology (ISSN 8750-7587), vol. 72, no. 6, June 1992, p. 2181-2187. refs Copyright

The feasibility of using BIA (bioelectrical impedance analysis) to assess body composition changes associated with body weight (BW) loss at high altitude was determined. Height, BW, BIA, skinfold (SF) and circumference (CIR) measurements were obtained from 16 males before, during and after 16 days residence at 3700-4300 m, as well as hydrostatic weighings (HW) before and after residence. Previously derived prediction equations using various combinations of these measurements as independent variables were used to predict fat-free mass (FFM), fat mass (FM), and percent body fat and results were compared with HW. BIA and SF methods overestimated the loss in FFM and underestimated the losses in FM and percent body fat (P less than 0.01). Equations utilizing CIR measurements were consistent with HW for changes in FFM, FM, and percent body fat. It was concluded that BIA and SF methods are not acceptable for assessing body composition changes at altitude. A.O.

A92-44636

**MUSCLE ACCOUNTS FOR GLUCOSE DISPOSAL BUT NOT BLOOD LACTATE APPEARANCE DURING EXERCISE AFTER ACCLIMATIZATION TO 4,300 M**

G. A. BROOKS, E. E. WOLFEL, B. M. GROVES, PAUL R. BENDER, G. E. BUTTERFIELD, A. CYMERMAN, R. S. MAZZEO, J. R. SUTTON, R. R. WOLFE, and J. T. REEVES (Colorado, University, Denver; U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Journal of Applied Physiology (ISSN 8750-7587),

vol. 72, no. 6, June 1992, p. 2435-2445. Research supported by Cigarette and Tobacco Surtax Fund of the State of California, University of California, and Shaklee Corp. refs (Contract NIH-HL-14985; NIH-DK-19577) Copyright

N92-26263\*# Pennsylvania Univ., Philadelphia. Inst. for Environmental Medicine.

**BIOCHEMICAL, ENDOCRINE, AND HEMATOLOGICAL FACTORS IN HUMAN OXYGEN TOLERANCE EXTENSION: PREDICTIVE STUDIES 6 Final Report**

C. J. LAMBERTSEN and J. M. CLARK 31 Mar. 1992 112 p (Contract NAG9-342)

(NASA-CR-190341; NAS 1.26:190341) Avail: NTIS HC/MF A06

The Predictive Studies VI (Biochemical, endocrine, and hematological factors in human oxygen tolerance extension) Program consisted of two related areas of research activity, integrated in design and performance, that were each based on an ongoing analysis of human organ oxygen tolerance data obtained for the continuous oxygen exposures of the prior Predictive Studies V Program. The two research areas effectively blended broad investigation of systematically varied intermittent exposure patterns in animals with very selective evaluation of specific exposure patterns in man. D.R.D.

N92-26470# Navy Clothing and Textile Research Facility, Natick, MA.

**EFFECTIVENESS OF A SELECTED MICROCLIMATE COOLING SYSTEM IN INCREASING TOLERANCE TIME TO WORK IN THE HEAT. APPLICATION TO NAVY PHYSIOLOGICAL HEAT EXPOSURE LIMITS (PHEL) CURVE 5 Final Report, Jun. 1988 - Mar. 1989**

NANCY A. PIMENTAL and BARBARA A. AVELLINI Jan. 1992 36 p

(AD-A246529; NCTRF-181) Avail: NTIS HC/MF A03

The effectiveness of a passive cooling ice vest in reducing heat strain was evaluated. The SteeleVest is a canvas vest with pockets which hold frozen gel packs against the torso (total weight 5.1 kg). Eight test volunteers attempted 10, 4-hour heat exposures (five environments, with and without the vest) in hot-humid and hot-dry environments having wet bulb globe temperatures (WBGT) of 36-39 C. Dry bulb temperatures ranged from 38-49 C, with 25-80 percent relative humidity. Subjects wore the Navy utility uniform and exercised at 272 W. This corresponded to a work rate equivalent to the Navy PHEL Curve 5. In all environments, the SteeleVest significantly reduced thermal strain, as evidenced by reduced rectal and skin temperatures, heart rate, and sweat rate. Use of the SteeleVest approximately doubled tolerance times compared with tests without the vest. The gel packs lasted approximately 2 hours before they required replacement. When the hot-humid and hot-dry environments having equivalent WBGT's were compared, thermal strain was higher in the more humid environments. In addition to its effectiveness in reducing heat strain, the SteeleVest is relatively lightweight, has a low profile, requires little maintenance, and is not susceptible to mechanical problems. These characteristics make it potentially feasible for shipboard use. GRA

N92-26512# Johns Hopkins Univ., Baltimore, MD. Dept. of Epidemiology.

**ADVERSE REPRODUCTIVE EVENTS AND ELECTROMAGNETIC RADIATION**

W. STEWART and R. OUELLET-HELLSTROM 31 Jul. 1991 44 p Sponsored by NIOSH, Cincinnati, OH

(Contract NIOSH-R01-OH-02373)

(PB92-145796) Avail: NTIS HC/MF A03

In 1989, approximately 42,000 questionnaires were mailed to female physical therapists to assess the risk of adverse reproductive effects among those exposed to electromagnetic radiation at radio frequencies. From the resulting data, the risk of early recognized fetal loss was assessed using a nested case-control design. The cases (1753 miscarriages) were matched to controls (1753 other pregnancies except ectopics) on mother's

age at conception and the number of years elapsed between conception and interview. The results of the study indicate that female physical therapists who work with microwave diathermy 6 months prior to the pregnancy and/or during the first trimester were at increased risk of experiencing a recognized early fetal loss, but female physical therapists who work with shortwave diathermy were not at an increased risk. This association was shown to hold even when the mother's age at conception, the number of years elapsed between conception and interview, the number of prior early fetal losses, mother's conditions ever diagnosed, and use of other modalities were controlled. The data also suggest a possible association between exposure to transcutaneous electrical nerve stimulation with an elevated risk of early recognized fetal loss. GRA

**N92-27011#** Design Models, Inc., Los Angeles, CA. Space Projects Group.

**ARCHITECTURAL STUDIES RELATING TO HUMAN BODY MOTION MORPHOLOGY IN MICROGRAVITY**

REGIS FAUQUET and JUN OKUSHI *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1037-1043 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

In microgravity the human body experiences dramatic postural physiological and perceptual changes. These transformations make a human being in weightlessness a different person with different needs. Mobility becomes a central issue of human life in orbit where the absence of gravity constitutes a handicap. The architectural layout of the hardware in a space habitat must not only be engineered properly, but also be tailored to the mobility needs of the human body in microgravity. Thus, the interface between human movements and the environment must be observed to understand the morphology of body motion and to assess what types of environmental conditions have the greatest potential to support adequately human mobility in weightlessness. From these observations a tentative elementary taxonomy of movements was formulated to serve as a design reference tool. The current definition of body envelope was expanded to take on consideration the kinetic characteristics of human motion that revealed geometries with intriguing implications for the design of future space habitats. ESA

**N92-27012#** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. of Aerospace Medicine.

**LBNP AS COUNTERMEASURE: AN AUTOMATED SCENARIO**

FRIEDHELM BAISCH, LUIS BECK, FRANK KIRCHNER, and DIEGO LOYOLA *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1045-1048 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Restitution of body fluids to Earth based standards is desirable for astronauts preparing their return to Earth after a prolonged space mission. Repeated Lower Body Negative Pressure (LBNP) application can assist in reaching this objective. However, use of rigorous LBNP profile includes the risk of syncope. A system that allows controlled LBNP application to minimize risks is described. The system enables the user to define an LBNP exposure profile. While a given profile runs, the system records and analyzes different physiological signals and provides online monitoring capability for critical parameters. Systolic, diastolic, and mean blood pressure derived by a 'Port a pres' (trademark) device, heart rate for electrocardiogram and a stroke volume correlate can be displayed on a beat by beat basis. The LBNP session can be both terminated by the system itself according to the predefined exposure profile or by an independent observer. It is planned to increase the system's capabilities by including intelligent features such as recognition of critical hemodynamic patterns. This would trigger automatic interruption of LBNP application. A system of such characteristics could enable routine LBNP application on a space

station without increasing operational burden and increase LBNP's efficiency as a countermeasure. ESA

**N92-27063#** Weizmann Inst. of Science, Rehovoth (Israel). **LOW POWER LASER IRRADIATION EFFECT WITH EMPHASIS ON INJURED NEURAL TISSUES** Midterm Report, 1 Mar. 1990 - 31 Mar. 1991

MICHAEL SCHWARTZ and MICHAEL BELKIN 1 Apr. 1991 26 p

(Contract DAMD17-90-Z-0008; DA PROJ. 3M1-62787-A-878) (AD-A246410) Avail: NTIS HC/MF A03

A few years ago, the use was initiated of lower power helium neon (He-Ne) laser (632.8 nm) for the treatment of injured nerves of the central nervous system (CNS) and of the peripheral nervous system. In those early studies it was shown that the low energy He-Ne laser treatment, if started immediately after injury, delays the posttraumatic degeneration but does not prevent it. We have suggested that the use of such treatment might be beneficial in cases of marginally injured axons which do not degenerate as a result of the primary lesion, but will degenerate as a second event and cases of severe injuries, in combination with a treatment modality which induces or facilitates growth. It was shown that the most successful growth of injured adult rabbit optic nerve (a nonregenerative system) into their own degenerative environment, which is hostile to growth when treatment is omitted. A daily irradiation for 10-14 consecutive days combined with application at the time of the injury of soluble substances, shown to facilitate growth, resulted in abundant growth of axons from the retinal ganglion cells of the injured fibers of optic nerves, as well as from the cut tips of the the injured fibers. GRA

**N92-27068\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 362)**

May 1992 118 p

(NASA-SP-7011(362); NAS 1.21:7011(362)) Avail: NTIS HC A06: NTIS standing order as PB92-912300, A03

This bibliography lists 357 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during May 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

**N92-27349#** California Univ., Berkeley. Lawrence Berkeley Lab.

**THE CARCINOGENIC RISKS OF LOW-LET AND HIGH-LET IONIZING RADIATIONS**

J. I. FABRIKANT Aug. 1991 37 p Presented at the 32nd Annual Meeting of the Japan Radiation Research Society, Kitakyushu-shi, Japan, 29 Aug. 1989 Revised

(Contract DE-AC03-76SF-00098) (DE92-010477; LBL-27728-REV; CONF-8908169-1) Avail: NTIS HC/MF A03

This report presents a discussion on risk from ionizing radiations to human populations. Important new information on human beings has come mainly from further follow-up of existing epidemiological studies, notably the Japanese atomic bomb survivors and the ankylosing spondylitis patients; from new epidemiological surveys, such as the patients treated for cancer of the uterine cervix; and from combined surveys, including workers exposed in underground mines. Since the numerous and complex differences among the different study populations introduce factors that influence the derived risk estimates in ways that are not completely understood, it is not clear how to combine the different risk estimates obtained. These factors involve complex biological and physical variables distributed over time. Because such carcinogenic effects occur too infrequently to be demonstrated at low doses, the risks of low-dose radiation can be estimated only by interpolation from observations at high doses on the basis of theoretical concepts, mathematical models, and available empirical evidence, primarily

the epidemiological surveys of large populations exposed to ionizing radiation. In spite of a considerable amount of research, only recently has there been an effort to apply the extensive laboratory data in animals to define the dose-incidence relationship in the low dose region. There simply are insufficient data in the epidemiological studies of large human populations to estimate risk coefficients directly from exposure to low doses. The risk estimates for the carcinogenic effects of radiation were, in the past, somewhat low, and reassessment of the numerical values is now necessary. DOE

**N92-27361#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**ARTERIO-VEINUS ANASTOMOSES AND THERMOREGULATION Final Report [ARTERIO-VEINEUZE ANASTOMOSEN EN THERMOREGULATIE]**

H. A. M. DAANEN 22 Aug. 1991 20 p  
(AD-A245385; IZF-1991-B-12; TDCK-TD-91-3296) Avail: NTIS HC/MF A03

In a cold environment, human heat loss is reduced by peripheral vasoconstriction, counter-current heat exchange, and a change of peripheral circulation pattern. However, these mechanisms go at the expense of the tissue temperature in the extremities. The cooling can be so pronounced that local cold injuries occur. Cold induced vasodilation (CIVD) may be regarded as an effective protection against local cold injury. The underlying mechanism is often associated with the presence of arterio-venous anastomoses (AVA). Rhythmic relaxation and contraction of the strong muscular wall of the AVA is often supposed to cause the hunting response in CIVD. The contraction phase is probably caused by stimulation of the alpha-adrenoceptors in the smooth muscle wall. Relaxation may be caused by a nervous blockade of the sympathetic system. There is no scientific evidence for humeral mediators. The influence of the body temperature on the vasomotor tone of the AVA remains to be investigated. The locations of AVA and the sites where CIVD occurs are not in perfect correspondence and also this point needs further research. GRA

**N92-27371#** Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.

**THE SCOPE OF ACCELERATION-INDUCED LOSS OF CONSCIOUSNESS RESEARCH Final Report, May 1988 - May 1991**

JAMES E. WHINNERY 4 Jul. 1991 16 p  
(AD-A247872; NADC-91079-60) Avail: NTIS HC/MF A03

Acceleration induced loss of consciousness (G-LOC) is a major fighter aviation medicine problem. To effect an ultimate solution for G-LOC it is critical to have a thorough understanding of the problem. Research related to unconsciousness is spread across a multitude of disciplines. It is, therefore, a valuable exercise to develop the overall scope of relevant research that pertains to G-LOC. This not only serves to bring together the body of information that is important for understanding G-LOC, it also provides for the development of the scope of importance that G-LOC research has for other specific and clinical disciplines. The purpose of this review is to establish the relationship between biomedical research whose primary goal is aviation oriented and the clinical and basic research that is intricately associated with unconsciousness and may benefit from the results of G-LOC research. GRA

**N92-27433\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 361)**

Apr. 1992 56 p  
(NASA-SP-7011(361); NAS 1.21:7011(361)) Avail: NTIS HC A04; NTIS standing order as PB92-912300, A03

This bibliography lists 141 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Mar. 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

**N92-27702#** Concordia Univ., Montreal (Quebec). Dept. of Biology.

**DIMINISHING RADIATION DAMAGE AND ENHANCING IMMUNE SYSTEM RECOVERY: A STUDY Final Report, 1 Jan. 1989 - 28 Feb. 1991**

R. M. ROY 21 Mar. 1991 31 p  
(Contract DSS-055SS.W7714-8-5726)  
(DREO-CR-91-646; CTN-92-60494) Avail: NTIS HC/MF A03

The modifying effects of tocopherol, lipoic acid, lithium carbonate, nicotinamide, 3-amino benzamide, sodium linoleate and sodium succinate administered to primary splenic lymphocytes at various concentrations, times, and in combinations were evaluated with respect to several parameters of radiation damage and recovery. With respect to interphase death, tocopherol, lithium carbonate and lipoic acid were clearly effective in reducing lethality when administered 0-12 hours after irradiation. A similar pattern of response modification was observed with respect to proliferative response to mitogens. The effects are more dramatic than those with interphase death and persist for at least 12 hours after irradiation in the case of lithium carbonate and at least 24 hours for tocopherol and lipoic acid. It was not possible to demonstrate repair of sublethal damage in irradiated lymphocytes. For lymphocyte humoral and cell-mediated immune functions, using in-vitro assays, tocopherol, lithium carbonate and lipoic acid may confer some stimulation of plaque-forming cell numbers in response to immunization. Chromium-51 release from labeled tumor target cells by irradiated sensitized lymphocytes is only affected, and only slightly, by nicotinamide. Author (CISTI)

**N92-27844#** Medical Coll. of Virginia, Richmond. Dept. of Neurology.

**THE EFFECTS OF HYDRAZINES ON NEURONAL EXCITABILITY Annual Report, 1 May 1988 - 31 May 1989**

ROBERT J. DELORENZO 10 Jan. 1992 21 p  
(Contract AF-AFOSR-0235-87)  
(AD-A247103; AFOSR-92-0110TR) Avail: NTIS HC/MF A03

Hydrazines are toxic compounds which have numerous military and industrial applications including missile propellants, and advanced aircraft (such as the F-16), and space vehicles. Because of recurrent exposure, due to routine storage and disposal of these compounds, understanding their toxic effects on the nervous system is important in the aerospace field. Toxic exposure to hydrazine can result in status epilepticus and eventual respiratory collapse. Acute hydrazines exposure can produce repeated tonic-clonic seizures in animals and man. This project has continued to direct its effort in understanding the molecular mechanism by which hydrazines may produce their neuronal excitatory effects. We have continued and expanded our investigation of the effects of hydrazine on specific electrophysiological properties on identified neurons in the invertebrate *Hermisenda crassicornis* and have expanded these studies to investigate the effects of hydrazine on isolated neurons in culture. Our studies have documented that hydrazines increase neuronal excitability in the LP-1 neuron of this nudibranch mollusc. Studies have been directed at further establishing the technical capability of investigating the effects of hydrazines on the rate of sustained repetitive firing. GRA

**N92-27968#** Rochester Univ., NY. Center for Visual Science. **REFERENCE FRAMES IN VISION Annual Report, 15 Jan. 1991 - 14 Jan. 1992**

MARY M. HAYHOE 18 Mar. 1992 6 p  
(Contract AF-AFOSR-0332-91)  
(AD-A248743; REPT-5-27959; AFOSR-92-0264) Avail: NTIS HC/MF A02

The goal of this project is to examine the consequences of observer motion for visual function. The research has focussed on two issues. One issue is how a grossly time-varying retinal input (because of eye, head, and body motion) results in the perception of a continuous and directionally stable visual world. A

## BEHAVIORAL SCIENCES

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

**A92-43008****HUMAN EVENT DETECTION BEHAVIOR MODEL IN MULTITASK SITUATION**

XIMIN WANG and HUAICHEN CHEN (Xidian University, Xian, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 30-37. In Chinese. refs

A model of human multitask event detection was developed in terms of human behavior characteristics. Normative mathematical models were developed based on modern estimation theory and classical detection theory. The constitution of the present models and the parameter selection are more explainable than in previous models. A comparison between model prediction and human performance is made. C.D.

**A92-43114****STUDY ON ZERO FLIGHT TIME TRAINING**

K. IWASE (Japan Airlines, Technical Institute, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 104-107. In Japanese.

A pilot training program using a computer-aided simulator is presented. The requirement for establishing the zero flight training system is discussed. Comparisons between Japanese and other countries' pilot training data are presented. Y.P.Q.

**A92-43165****A SIMULATOR FOR PILOT AND CREW TRAINING**

M. WATANABE IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 322-325. In Japanese. refs

A simulator for antitank helicopters is described. The simulated emergency status design and training methods are described and future applications of the simulator are considered. Y.P.Q.

**A92-43967\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**IDENTIFYING TACIT STRATEGIES IN AIRCRAFT MANEUVERS**

CHARLES M. LEWIS and P. B. HEIDORN (Pittsburgh, University, PA) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 21, no. 6, Nov.-Dec. 1991, p. 1560-1571. refs (Contract NAG2-123)

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Two machine-learning methods are presently used to characterize the avoidance strategies used by skilled pilots in simulated aircraft encounters, and a general framework for the characterization of the strategic components of skilled behavior via qualitative representation of situations and responses is presented. Descriptions of pilot maneuvers that were 'conceptually equivalent' were ascertained by a concept-learning algorithm in conjunction with a classifier system that employed a generic algorithm; satisfying and 'buggy' strategies were thereby revealed. O.C.

**A92-44422****COGNITIVE STYLE AND VISUAL REACTION TIME**

JAN TERELAK (Military Institute of Aviation Medicine, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 24, no. 1-2, 1992, p. 33-40. refs

Copyright

This paper is devoted to the relations between the field-dependent/independent cognitive style and the visual reaction time. Young boxers (16-17 years) with different levels of field-dependence are compared in their processing of visual stimuli. Boys within the 16 to 17 yr age range served as subjects. Cognitive

second issue concerns how the information in successive views is related, and the nature of the visual information retained from previous views. Understanding these processes is important for a wide variety of visual-motor tasks. In the past year progress has been made on the following six projects: (1) the role of the visual scene and eye position signals in visual stability; (2) the role of attention in integrating across saccades; (3) reference frames for spatial memory; (4) hand-eye coordination during complex tasks; (5) detectability of changes during saccades; and (6) short term visual memory of complex scenes. GRA

**N92-28135#** Armed Forces Inst. of Pathology, Washington, DC. **INSPIRED GAS COMPOSITION INFLUENCES RECOVERY FROM EXPERIMENTAL VENOUS AIR EMBOLISM Annual Report, 1 Jul. 1990 - 30 Jun. 1991**

JOSEPH A. BETTENCOURT, CHARLES M. HARRISON, THEODORE PLEMONS, PATRICIA L. SCHLEIFF, and WILLIAM J. MEHM 30 Jun. 1991 22 p

(Contract AF-AFOSR-0317-90)

(AD-A247004; AFOSR-92-0134TR) Avail: NTIS HC/MF A03

Venous air embolism (VAE) is a potentially fatal occurrence frequently encountered in neurosurgical procedures performed in the sitting position. The morbidity of this event was reduced primarily by efforts at early detection and prevention. Clinically, VAE is accompanied by hypoxia, hypercarbia, and an increase in dead space, manifested initially by a precipitous fall in end tidal carbon dioxide (ETCO<sub>2</sub>). Treatment consists of identifying and controlling the source, and hyperventilation on 100 percent oxygen. Hemodynamic support is given as required. A canine model of VAE was used to evaluate the effect of different inspired gas mixtures on the recovery from continuous venous air infusion. Sulfur hexafluoride (SF<sub>6</sub>), a non-hyperoxic, nitrogen free inspired gas was tested to determine if it would be a preferable alternative to recovery on 100 percent oxygen. Residual air effect was identified after the recovery period by a nitrous oxide challenge. In this study, recovery from VAE on 100 percent oxygen, as determined by response to nitrous oxide, was demonstrated to be significantly superior to either room air or SF<sub>6</sub>. ETCO<sub>2</sub>, pulmonary artery diastolic pressure (PAD) and arterial oxygen tension (PaO<sub>2</sub>) all demonstrated a greater ability to tolerate the nitrous oxide challenge in subjects recovered with 100 percent oxygen. GRA

**N92-28212\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**METABOLIC ENERGY REQUIREMENTS FOR SPACE FLIGHT**

HELEN W. LANE 1992 29 p

(NASA-TM-107933; NAS 1.15:107933) Avail: NTIS HC/MF A03

The international space community, including the USSR, Japan, Germany, the European Space Agency, and the US, is preparing for extended stays in space. Much of the research planned for space will be tended by humans, thus, maintaining adequate nutritional status during long stays in space has lately become an issue of much interest. Historically, it appears that minimum nutritional requirements are being met during stays in space. Thus far, crewmembers have been able to consume food adequate for maintaining nominal performance in microgravity. The physiological data obtained from ground-based and flight research that may enable us to understand the biochemical alterations that effect energy utilization and performance. Focus is on energy utilization during the Apollo lunar missions, Skylab's extended space lab missions, and Space Shuttle flights. Available data includes those recorded during intra- and extravehicular activities as well as during microgravity simulation (bed rest). Data on metabolism during flight and during bed rest are discussed, with a follow-up on human gastrointestinal function. Author

style was assessed on Witkin's Group Embedded Figures Test. Visual reaction time was examined by means of the MRK-433 chronometer. Higher scores on field-independence were associated with better performance on the choice visual reaction time.

Author

**N92-26992#** Compagnia Italiana Servizi Tecnici, Rome. Space Div.

**CBT: ROLE AND FUTURE APPLICATION FOR CREW TRAINING**

A. GUERRAZZI, S. MASULLO, S. RANDISI, and E. SALA /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 905-909 Dec. 1991  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A set of Computer Based Training (CBT) tools for crew training are considered. These tools are seen and described as a complementary means with the other training facilities needed to conduct an efficient training program for this flight crew. Their current capabilities are explored and explained in order to show how their use can improve training achievements within time and budget constraints. The basic features are analyzed for comparison with the other tools usually used: ease in learning; response analysis; courseware update and upgrade; multimedial techniques (audio, video, text, graphics, etc.). Their possible architecture for the specific application of crew training is addressed, taking into account the necessity of having a coherence of the various coursewares in a possible European scenario. Requirements in terms of hardware and software are consequently derived for minimal and optimal configurations with the related benefits and drawbacks. Recommendations for implementation in the future crew training environments are addressed. ESA

**N92-27047** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Traffic Behavior Group.

**SELECTIVE SEARCH FOR THE TARGET PROPERTIES COLOR AND FORM Final Report [SELECTIEF ZOEKEN NAAR KLEUR EN VORM]**

J. THEEUWES 4 Sep. 1991 24 p Sponsored by TNO Defence Research (IZF-1991-B-13; TD91-3298; ETN-92-91236) Copyright Avail: TNO Inst. for Perception, Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

Three search experiments are used to test whether the preattentive parallel stage of visual processing can selectively guide the attentive stage to a particular known-to-be-relevant-target feature. Subjects search multielement displays for a salient green circle which has a unique form when surrounded by green nontarget squares and a unique color when surrounded by red nontarget circles. In the distractor conditions, a salient item on the other dimension is also presented. As an extension of earlier findings the results shown that topdown selectivity towards a particular feature is not possible, even after extended and consistent practice. The results reveal that selectivity depends on the relative discriminability of the form and color dimension. In an additional analysis the effect of the distance between target and distractor is examined. ESA

**N92-27331#** California Univ., Berkeley. School of Optometry. **SPATIO-TEMPORAL MASKING: HYPERACUITY AND LOCAL ADAPTATION Annual Report, 1 Jan. 1990 - 31 Dec. 1991**  
STANLEY A. KLEIN 5 Feb. 1992 5 p  
(Contract AF-AFOSR-0238-89)  
(AD-A246953; AFOSR-92-0131TR) Avail: NTIS HC/MF A01

Our development of an ideal-observer framework and a test-pedestal methodology for modeling vision without the numerous assumptions of previous models has provided a comprehensive understanding of the spatio-temporal characteristics of human vision. The methodology encompasses a limited set of test stimuli with a multiplicity of pedestals to facilitate the comparison of performance across many psychophysical tasks. For example, it is shown that vernier acuity can generally be predicted from an individual's contrast discrimination threshold.

For the conditions under which contrast discrimination predictions break down, a detailed modeling of later stages of visual processing is required. As a result, specifications for a vision modeling tool have been developed to guide the creation of a comprehensive vision modeling environment. As our models of visual function have matured, we have applied them to practical issues such as image compression and image quality. Consideration of properties of human vision is essential if the image compression needed for new technologies such as HDTV are to avoid sacrificing image quality. The success of the test-pedestal methodology has also lead us to record human visual evoked potentials so that we may integrate our psychophysical data and models of vision with underlying physiological mechanisms. GRA

**N92-27337#** California Univ., Berkeley. Dept. of Psychology. **NORMS AND THE PERCEPTION OF EVENTS Annual Report, 15 Jun. 1990 - 5 Sep. 1991**

DANIEL KAHNEMAN 5 Sep. 1991 33 p  
(Contract AF-AFOSR-0206-88)  
(AD-A247032; AFOSR-92-0103TR) Avail: NTIS HC/MF A03

The major effort of the research reported here has been directed to understanding multiple representations in thinking and processes of comparison in different domains. Five distinct projects address issues of interpersonal versus intrapersonal comparisons, mental contamination, anchoring effects, topic and referent in perceptual comparison, and reference effects in choice. GRA

**N92-27444#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**ATTENTIONAL DEMANDS AND EFFECTS OF EXTENDED PRACTICE IN A ONE-FINGER KEY-PRESSING TASK Final Report [AANDACHT EN EFFECTEN VAN OEFENING IN EEN SEQUENTIELE TOETSDRUKTAAK]**

W. B. VERWEY 23 Oct. 1991 21 p  
(AD-A245384; IZF-1991-B-15; TDCK-TD-91-3305) Avail: NTIS HC/MF A03

This paper attempts to define mechanisms for producing rapid movement sequences early and late in practice. Twelve subjects completed eight hours of practice on a task in which a response consisted of a sequence of three key presses, the first two of which were fixed over all trials while the third was stimulus dependent. In some dual task blocks a low or a high pitched tone was presented during various phases of sequence production in order to determine attentional demands of sequence preparation and execution. The results show that attentional resources are required for preparing but not for executing the sequence. Extended practice was found to gradually improve anticipation of response production but no evidence was found for qualitative changes in the way the sequences were produced as suggested by notions of distributed programming and response integration. Secondary task interference reduced only little with practice. The present results provide further evidence for the notion that a general principle of producing movement sequences underlies one and multi-finger key press sequences. In contrast to assumptions of multiple resource theories about parallel processing the results suggest that when more than one task requires attention at the same time, limited attentional resources are and remain a major bottle-neck for dual task performance. This is evidence for a single channel model of task performance. GRA

**N92-27500#** Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

**EFFECTS OF COLOR VISION DEFICIENCY ON DETECTION OF COLOR-HIGHLIGHTED TARGETS IN A SIMULATED AIR TRAFFIC CONTROL DISPLAY Final Report**

HENRY W. MERTENS, RICHARD I. THACKRAY, and MARK TOUCHSTONE Jan. 1992 11 p  
(AD-A246586; DOT/FAA/AM-92/6) Avail: NTIS HC/MF A03

The present study sought to evaluate the effects of color vision deficiency on the gain in conspicuity that is realized when color-highlighting is added as a redundant cue to indicate the presence of unexpected, nontracked aircraft intruding in controlled airspace. Sixteen subjects with severe color vision deficiency, both

protan and deutan types, and eight subjects with normal color vision performed a simulated high-workload air traffic control task over a 1-hour period. Displayed information was normally green. In addition to the primary task, subjects also monitored for occasional intrusions by light aircraft identifiable on the basis of triangular shape alone or with the color red added as a redundant cue. The luminance of the red color was also 30 percent higher. Detection of red targets was slightly slower than detection of green targets in protans. In contrast, detection was faster with red targets for both normals and deutan subjects. Impairment in performance of the severe protans with red highlighting was attributed to their well known reduced sensitivity to red light. Although severe deutans have reduced color discrimination, they do not usually have reduced sensitivity, and their performance was probably enhanced by the greater brightness of red targets. These results demonstrate that the approach of using color always as a redundant cue to ensure performance of color deficient, is valuable, but the potential for adverse interaction of color coding with color deficiency must always be considered. GRA

**N92-27501#** Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

**GENDER, EQUITY, AND JOB SATISFACTION Final Report**  
L. A. WITT and LENDELL G. NYE Feb. 1992 12 p  
(AD-A246588; DOT/FAA/AM-92/9) Avail: NTIS HC/MF A03

Although equity theory has served as a theoretical framework applying to most individuals in most situations, empirical research suggests that gender may affect the utility of equity theory in explaining organizational behaviors. Studies have indicated that men are more likely than women to distribute outcomes to individuals in direct proportion to their input. This gender difference has brought about considerable research interest and concern for implications in work groups and in supervisor-subordinate interactions. Brockner and Adsit noted an important but untested implication that the equity norm is more salient for men than it is for women. They argued that men's satisfaction with an exchange relationship should be influenced by the presence or absence of equity more so than women's satisfaction. They reported data indicating that the equity-satisfaction relationship was considerably stronger among men than among women. The Brockner and Adsit finding has an important implication for organization theory, namely that equity perceptions may be more salient among men than women in the development of job satisfaction. Replication of their findings would suggest a need for further research in this area and a possible utility of different strategies for managing men and women for purposes of promoting job satisfaction with a focus on equity-related issues and antecedents. GRA

**N92-27509#** Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Psychology.

**WHAT AND WHERE IN VISUAL ATTENTION: EVIDENCE FROM THE NEGLECT SYNDROME**

MARTHA J. FARAH, MARCIE A. WALLACE, and SHAUN P. VECERA Jan. 1992 36 p  
(Contract N00014-91-J-1546)  
(AD-A246932; CN-ONR-1) Avail: NTIS HC/MF A03

From what types of visual representations does attention select stimuli for further processing? Two alternatives that have been investigated within cognitive psychology are: array, or location-based representations, and object-based representations. We briefly review the literature on this issue in normal subjects, and then report two experiments on the same issue using parietal-damaged patients with visual neglect. The findings from neglect patients are then discussed with respect to the clinical literature on the effects of bilateral parietal damage, and the classical distinction between the spatial functions of the dorsal visual system and the object identification functions of the ventral system. GRA

**N92-27512#** California Univ., Berkeley.  
**INVESTIGATION OF DYNAMIC ALGORITHMS FOR PATTERN RECOGNITION IDENTIFIED IN CEREBRAL CORTEX Final Report, 1 Sep. 1988 - 31 Aug. 1991**

WALTER J. FREEMAN 2 Dec. 1991 9 p  
(Contract AF-AFOSR-0268-88)

(AD-A247860; AFOSR-92-0112TR) Avail: NTIS HC/MF A02

Patterns of 40 to 80 Hz oscillation have been observed by researchers of this laboratory in the large scale activity not only of olfactory cortex, but also visual neocortex, and shown to predict the olfactory and visual pattern recognition responses of a trained animal. Similar observations of 40 Hz oscillation in auditory and motor cortex, and in the retina and EMG have been reported. Thus, it appears that cortical computation in general may occur by dynamical interaction of resonant modes, as we have long thought to be the case in the olfactory system. The oscillation can serve a macroscopic clocking function and entrain or 'bind' the relevant microscopic activity of disparate cortical regions into a well defined phase coherent collective state of 'gestalt'. This can override irrelevant microscopic activity and produce coordinated motor output. We have further evidence that the oscillatory activity is roughly periodic, but actually appears to be chaotic (nonperiodic) when examined in detail. GRA

**N92-27535#** Naval Research Lab., Washington, DC.

**DUAL-TASK PERFORMANCE AS A FUNCTION OF PRESENTATION MODE AND INDIVIDUAL DIFFERENCES IN VERBAL AND SPATIAL ABILITY Final Report**

LISA B. ACHILLE, ASTRID SCHIMIDT-NIELSEN, and LINDA E. SIBERT 31 Jan. 1992 24 p  
(AD-A246611; NRL-9372) Avail: NTIS HC/MF A03

The effectiveness of alternative display formats as a function of individual differences in verbal and spatial abilities was evaluated in a dual-task paradigm. Tasks consisted of two dimensional tracking and a classification task in which items were presented as text, speech, or icons. Spatial ability was correlated with performance on the tracking task both for single task and for dual task in combination with the various presentation modes of the classification task. Verbal ability was not consistently correlated with performance on any of the tasks. Significant individual differences in dual task performance were found, and individuals were highly consistent with themselves across different presentation modes. Classification task performance is compared for the three presentation modes singly and in combination with the tracking task. Dual task classification was slower than single-task classification for the visual modes, but there was no increase in reaction time between single and dual task performance for speech. In the dual task conditions, the largest tracking performance decrements were found for the text conditions, with small decrements for speech, and smallest decrements for iconic presentations. Issues related to time sharing ability and strategies are also discussed. GRA

**N92-27537#** Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Systems and Logistics.

**A META-ANALYSIS OF PILOT SELECTION TESTS: SUCCESS AND PERFORMANCE IN PILOT TRAINING M.S. Thesis**

WILLIAM E. LYNCH Sep. 1991 74 p  
(AD-A246623; AFIT/GLM/LSM/91S-44) Avail: NTIS HC/MF A04

The purpose of this study was to determine if the characteristics measured by the Air Force Officer Qualifying Test Pilot Composite and Navy/Marine Flight Aptitude Rating were significantly correlated to the successful completion of flight training. Meta-analysis was used to calculate the mean weighted average correlation, and correct for sampling error, error of measurement, restriction of range, and dichotomization. Over 200 studies were considered for the meta-analysis. The results indicate that both the uncorrected and fully corrected weighted mean correlations for a group of nine Air Force studies were statistically significant (p less than .0001). The partially corrected (sampling error and dichotomization) correlation for a group of eight Navy studies was also statistically significant (p less than .03), while the uncorrected weighted mean correlation was not significant (p greater than .05). There was no significant difference between the magnitude of the correlations (corrected and uncorrected) between the Navy and Air Force groups. The findings of this research indicate that both

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the Air Force Officer Qualifying Test Pilot Composite and Navy/Marine Flight Aptitude Rating are useful in selecting those candidates who are more likely to complete pilot training. GRA

**N92-27538#** California Univ., Irvine. Center for the Neurobiology of Learning and Memory.

**FOURTH CONFERENCE ON THE NEUROBIOLOGY OF LEARNING AND MEMORY Final Report, 1 Jul. 1990 - 1 Feb. 1991**

JAMES L. MCGAUGH, GARY LYNCH, NORMAN M. WEINBERGER, and LARRY R. SQUIRE 24 Feb. 1992 3 p  
Conference held in Irvine, CA, 17-20 Oct. 1990  
(Contract N00014-90-J-4008)  
(AD-A247174) Avail: NTIS HC/MF A01

This grant provided partial support for the Fourth Conference on the Neurobiology of Learning and Memory which was held at Irvine, California on October 17-20, 1990. The conference was organized and sponsored by the Center for the Neurobiology of Learning and Memory of the University of California, Irvine. The aim of the conference was to review current fact and theory concerning three research issues in the neurobiology of learning and memory: (1) the features and loci of patterns of brain activity induced by learning, (2) the roles of different brain systems in mediating learning and memory, and (3) cellular modifications underlying learning and memory. The presentations and discussions represented all levels of analysis from molecular neurobiology through systems/behavioral studies. There were 20 principal speakers, 98 poster presentations and over 300 registered participants representing 20 countries. A book based on the proceedings of the conference, *Memory: Organization and Locus of Change* (Larry R. Squire, Norman M. Weinberger, Gary Lynch and James L. McGaugh, Editors) is in press. GRA

**N92-27822#** Harvard Univ., Cambridge, MA. Dept. of Psychology.

**PET STUDIES OF COMPONENTS OF HIGH-LEVEL VISION**

15 Feb. 1992 3 p  
(Contract N00014-91-J-1243)  
(AD-A246449) Avail: NTIS HC/MF A01

We have now tested twelve subjects in an experiment in which we study how objects are identified when seen from an unusual point of view. As noted in earlier quarterly reports, this study will allow us to test a prediction of Kosslyn, Flynn, Amsterdam and Wang (1990); this theory led us to expect processes in the parietal lobe (involved in shifting attention) and in the frontal lobe (involved in formulating hypotheses) to be invoked when subjects identify pictures of object seen from an unusual point of view but not when objects are seen from canonical points of view. The subjects have participated in three conditions: (1) they see a series of pictures of objects seen from a canonical point of view; (2) they see a series of pictures of objects from an unusual point of view; (3) they see random noise patterns. In all three conditions, the subjects hear a word immediately before each picture is presented. In the first two conditions, they verify whether the word names the picture; in the third (baseline) condition, they simply press a pedal when they hear the word. GRA

**N92-27825#** University of Southern California, Los Angeles. Dept. of Psychology.

**HUMAN IMAGE UNDERSTANDING Annual Progress Report, 1 Jun. 1989 - 22 Dec. 1990**

IRVING BIEDERMAN 18 Dec. 1991 22 p  
(Contract AF-AFOSR-0231-88)  
(AD-A247048; AFOSR-92-0135TR) Avail: NTIS HC/MF A03

An extensive series of experiments assessing the visual priming of briefly presented images indicates that the visual representation that mediates real-time object recognition specifies neither the image edges or vertices nor an overall model of the object, but an arrangement of simple volumes (or geons) corresponding to the object's parts. This representation can be activated with no loss in efficiency when the image is projected onto the retina at another position, size, or orientation in depth from when originally viewed. Consideration of these invariances suggests a

computational basis for the evolution of two extrastriate visual systems, one for recognition and the other subserving motor interaction. The experiments suggest that it may be possible to assess the functioning of these systems behaviorally, that is, to split the cortex horizontally, through a comparison of performance on naming and episodic memory tasks. We have developed a neural network model that captures the essential characteristics of human object recognition performance. The model takes a line drawing of an object as input and generates a structural description which is then used for object classification. GRA

**N92-27839#** Yale Univ., New Haven, CT. School of Medicine.  
**STRESS-INDUCED ENHANCEMENT OF THE STARTLE REFLEX Annual Report, 1 Oct. 1990 - 30 Sep. 1991**

MICHAEL DAVIS 26 Dec. 1991 7 p  
(Contract AF-AFOSR-0035-91)  
(AD-A247096; AFOSR-92-0109TR) Avail: NTIS HC/MF A02

The goals of the research are to study neural systems involved in the production and inhibition of fear and anxiety. Previous research has found that the acoustic startle reflex is sensitive to both fear and stress. Many effects produced by fear or stress are mimicked by infusion of the peptide corticotropin releasing factor (CRF) directly into the brain. This year we have found that infusion of CRF into the brain causes a pronounced, dose-dependent enhancement of the acoustic startle reflex in rats. This excitatory effect was blocked by a CRF antagonist or by lesions of the amygdala, a brain structure known to be involved in fear and stress. The present data indicate that the amygdala is part of the neural circuitry required for CRF to elevate startle. Because startle is mediated by a well-defined neural pathway, CRF-enhanced startle is a useful behavioral assay to analyze the neural systems upon which exogenous CRF acts to produce its behavioral effects. GRA

**N92-27863#** Dayton Univ. Research Inst., OH.  
**AREA-OF-INTEREST DISPLAY RESOLUTION AND STIMULUS CHARACTERISTICS EFFECTS ON VISUAL DETECTION THRESHOLDS Final Technical Report, Dec. 1989 - Oct. 1990**

HAROLD D. WARNER, DAVID C. HUBBARD, and GARY SERFOSS Feb. 1992 34 p  
(Contract F33615-90-C-0005)  
(AD-A247830; AL-TR-1991-0134) Avail: NTIS HC/MF A03

An investigation was conducted to examine the effects of area-of-interest (AOI) display resolution and various stimulus characteristics on visual detection thresholds using the Limited Field-of-View Dome (LFOVD) visual simulation system located at the Aircrew Training Research Division, Human Resources Directorate of the Armstrong Laboratory at Williams Air Force Base, Arizona. Two levels of AOI resolution, which was defined as the width of the line spread function at 50 percent of the line's maximum luminance, were evaluated. The higher resolution level was 0.081 degree horizontal by 0.071 degree vertical, and the lower resolution level was 0.132 horizontal by 0.121 degrees vertical. The stimuli consisted of computer-generated striped and plain cylinder-shaped objects. The cylinders stood upright on the simulated terrain surface, and the stripes were placed midway between the top and bottom of the cylinders and completely encircled the cylinders. Detection thresholds were determined for both the cylinder stripes and the cylinders. The analysis of the cylinder stripes indicated that the threshold detection distances were greater with the higher resolution AOI and that the detection distances generally increased as stripe size, cylinder height, and cylinder diameter increased. The image generator load management parameters dictated the detection distances for the plain cylinders, except the smallest diameter cylinders. GRA

**N92-27910#** Aerospace Medical Research Labs., Brooks AFB, TX.

**VISUAL ATTENTION AND PERCEPTION IN THREE-DIMENSIONAL SPACE Final Report, Apr. - Aug. 1990**

FRED H. PREVIC, LISA F. WEINSTEIN, and BRUNO G. BREITMEYER Jan. 1992 18 p  
(AD-A247823; AL-TR-1991-0119) Avail: NTIS HC/MF A03

The effects of shifting attention to targets in 3-dimensional (3-D) visual space were investigated. The perceptibility of crossed-disparity (near) and uncrossed-disparity (far) targets located in the upper-left, upper-right, lower-left, and lower-right visual quadrants was measured during attention shifts that were directed by means of centrally presented arrows to the left or right, upper or lower, and near or far fields. Although left-right attention cues produced the expected perceptibility benefits, upper-lower cues produced no benefits and near-far ones produced attentional costs. The effect of shifting attention along the up-down axis using peripheral cues was also investigated; in this case, significant benefits were obtained, especially in the upper visual field. These results and those from basic detectability experiments point to the existence of important inhomogeneities in perceiving and attending to targets in 3-D visual space. GRA

**N92-27969#** Princeton Univ., NJ. Dept. of Psychology.  
**CAUSAL MODELS IN THE ACQUISITION AND INSTRUCTION OF PROGRAMMING SKILLS Final Report, Sep. 1987 - Aug. 1990**

BRIAN J. REISER Mar. 1992 42 p  
(Contract MDA903-87-K-0652)  
(AD-A248761; ARI-RN-92-90) Avail: NTIS HC/MF A03

This research project investigates how an interactive learning environment supports students' learning and acquisition of mental models when acquiring a target cognitive skill. For this project, we constructed GIL, an intelligent tutoring system for LISP programming. We used GIL to conduct pedagogical experiments on skill acquisition. Two ways in which an interactive learning environment will facilitate acquisition of novel complex domains were studied. The first set of studies examines how graphical representations provide a representation more congruent with students' reasoning. The second set examines how explanatory feedback, generated from the system's problem-solving knowledge, facilitates students' learning. The experiments demonstrate that computer-based support helps students construct effective models for reasoning in complex domains. GRA

**N92-27971#** Liege Univ. (Belgium). Lab. of Experimental Psychology.

**BEHAVIORAL VARIABILITY, LEARNING PROCESSES, AND CREATIVITY Final Report, Sep. 1985 - Dec. 1988**

MARC N. RICHELLE, BRUNO BOULANGER, ANNE-MICHELLE INGEBOS, and MARTINE LAHAK Mar. 1992 433 p  
(Contract DAJA45-85-C-0038)  
(AD-A248894; REPT-0012; ARI-RN-92-18) Avail: NTIS HC/MF A19

This research investigates properties of human behavioral variability. The behavioral variability is discussed in the theoretical framework of learning theory, developmental psychology, and the psychology of intelligence and creativity. Relevant aspects of scientific literature are reviewed. Experiments investigate the effects of environmental factors on the variability of sequences of responses as a function of age, of cognitive capacities, and of educational background (for the adult subjects). Researchers used an experimental device that allowed for a number of equally efficient behaviors. Strategies used by subjects were recorded in various situations with differing degrees of constraint on freedom. Findings indicate that the performance, the variability, and the capacity to adapt to environmental contingencies are limited by the subjects' developmental level but they are not directly tied to cognitive capacities or cognitive styles. The mastery of the task seems to be slightly related to the educational background. The results suggest that variability is an inherent dimension of behavior, sensitive to its consequences, and that the potential for variation depends on the mastery of a set of basic behavioral units. The results support the idea that variability can be approached within the frame of learning theory and that, as a basic aspect of problem solving and creativity, it can be influenced by teaching. GRA

**N92-27989#** Kent State Univ., OH. Dept. of Biological Sciences.

**INVOLVEMENT OF LIPID METABOLISM IN CHEMICAL TRANSMISSION PROCESSES AT MOSSY FIBER SYNAPSES**

**Annual Report, 1 Jan. - 31 Dec. 1991**

ROBERT V. DORMAN 29 Jan. 1992 5 p  
(Contract AF-AFOSR-0245-89)  
(AD-A247198; AFOSR-92-0139TR) Avail: NTIS HC/MF A01

In 1991 we continued our investigations on the involvement of membrane lipid metabolism in the presynaptic processes related to the evoked release of the neurotransmitter glutamate. In particular, we observed that the phospholipase A2-dependent release of arachidonic acid from mossy fiber membrane phospholipids may modulate transmitter secretion through interactions with protein kinase c (PKC). The activation of PKC may explain the previously observed facilitation of depolarization-evoked Ca<sup>2+</sup> accumulation and glutamate release induced by exogenous arachidonate. These facilitatory effects may be related to the induction of long-term synaptic potentiation, which is an accepted correlate of learning and memory. In addition, we obtained evidence that presynaptic receptor activation stimulates the synthesis of arachidonate-derived prostaglandins. Thus, the metabolism of arachidonic acid may play a central role in presynaptic plasticity. GRA

**N92-28050#** California Univ., San Diego. Dept. of Medicine.

**NEURAL BASIS OF MOTION PERCEPTION Annual Report, 1 Apr. 1990 - 31 May 1991**

V. S. RAMACHANDRAN 14 Feb. 1992 8 p  
(Contract AF-AFOSR-0414-89)  
(AD-A248411; AFOSR-92-0204TR) Avail: NTIS HC/MF A02

Our goal is to understand the neural basis of perception and to test computational models of visual processing. This year we have been pursuing 3 lines of research: (1) we have been continuing our earlier studies on 'motion capture', shape from shading, and stereopsis. Our research suggests that image segmentation (based on texture, occlusion can) profoundly influences the early visual processing of stereopsis, shape from shading, and motion correspondence; (2) we have begun to investigate the 'filling in' of 'artificial scotomas' and of scotomas produced by brain injury (our goal has been to understand surface interpolation); and (3) we have developed a new psychophysical technique for isolating and studying a fast contour system in human vision (a system that might correspond to the magnocellular pathway of physiologists) GRA

**N92-28094#** Massachusetts Inst. of Tech., Cambridge. Dept. of Brain and Cognitive Sciences.

**STRATEGIES TO SUSTAIN AND ENHANCE PERFORMANCE IN STRESSFUL ENVIRONMENTS Annual Technical Report, 15 Dec. 1990 - 14 Dec. 1991**

RICHARD J. WURTMAN, HARRY J. LYNCH, and ANDREW B. DOLLINS 10 Jan. 1992 9 p  
(Contract AF-AFOSR-0125-90)

(AD-A247197; AFOSR-92-0141TR) Avail: NTIS HC/MF A02

Three lines of study were outlined in the previous report: (1) to test the efficacy of the catecholamine precursor L-Tyrosine in reducing pilot performance deficits caused by sleep deprivation, (2) to assess the role of endogenous melatonin on various performance and behavioral indices through photic modulation of nocturnal melatonin secretion, and (3) to examine the effects on the same performance and behavioral variables of exogenous melatonin administered during the day. The data have been collected for all three studies, involving 14, 24, and 21 human volunteers respectively, and analysis is in progress. Preliminary analysis of the results are consistent with the hypotheses upon which the studies were predicated and provide a basis for a more fruitful continuation and elaboration of this investigation. GRA

**N92-28142#** Carnegie-Mellon Univ., Pittsburgh, PA.  
**THE 24TH CARNEGIE SYMPOSIUM ON COGNITION: THE NEURAL BASIS OF HIGH-LEVEL VISION Final Report**

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MARTHA J. FARAH Mar. 1992 3 p Symposium held in Pittsburgh, PA, 29-31 May 1991 (AD-A248460) Avail: NTIS HC/MF A01

The 24th Carnegie Symposium on Cognition was held on May 29-31, 1991. The papers presented covered the following topics: perception and object representation; category specificity and object recognition; visual processes in reading; recognition and conscious awareness; and top down processes in vision including attention and imagery. These topics were addressed by speakers from the fields of cognitive psychology, neuropsychology, and neurobiology. GRA

**N92-28164#** Naval Aerospace Medical Research Lab., Pensacola, FL.

### **THE INFLUENCE OF SUBJECT EXPECTATION ON VISUAL ACCOMMODATION IN THE DARK**

W. B. CUSHMAN Dec. 1991 14 p

(Contract DA PROJ. M00-96)

(AD-A245923; NAMRL-1366) Avail: NTIS HC/MF A03

The prospect of a pilots vision at night being reduced to a less than optimal state by night myopia has been debated for years in a large body of research. This report casts doubt on the existence of night myopia in young healthy pilots by presenting evidence that the accommodative reflex may be driven by direct cognitive control inputs. Direct cognitive control, based on an individual's expectation of accommodative range, could bias measures of night myopia if the measuring instruments are placed close to the subject's eyes. Subjects studied for this report demonstrated excellent visual performance in the dark, at a range of 20 ft, despite measured night myopia of up to 7.94 diopters. GRA

**N92-28170#** California Univ., Berkeley. Dept. of Psychology. **VISUAL PERCEPTION OF FEATURES AND OBJECTS Annual Report, 15 Sep. 1990 - 14 Sep. 1991**

ANNE M. TREISMAN 14 Sep. 1991 21 p

(Contract AF-AFOSR-0370-90)

(AD-A248578; AFOSR-92-0265TR) Avail: NTIS HC/MF A03

The research can be divided into work on (1) preattentive visual processing, and (2) work on visual memory and priming for previously perceived objects. Some of the main findings are covered. (1) We showed that parallel, preattentive processing of motion and orientation depends on the elements sharing the same direction of contrast. However, some cues to occlusion appear also to be available preattentively, since they can control the correspondence matching in apparent motion. Preattentive grouping can guide attention in patients with neglect even though the elements are not consciously available. (2) Token representations of two novel objects can apparently be formed in a single trial. Attention then selects one of the two for response and inhibits the other. Its memory trace may nevertheless remain available to prime or interfere with subsequent perception of the same object. Similar priming and interference effects in visual search suggest that practice and automation may also depend on specific memory traces for each display, and that these are affected by the type of perceptual processing required by the search task. GRA

**N92-28176#** Oregon Univ., Eugene. Dept. of Psychology. **VISUAL PROCESSING IN TEXTURE SEGREGATION Final Report, 1 Sep. 1988 - 30 Sep. 1991**

JACOB BECK 17 Dec. 1991 44 p

(Contract AF-AFOSR-0323-88)

(AD-A247173; AFOSR-92-0075TR) Avail: NTIS HC/MF A03

Two types of texture segregation occurs. Preattentive texture segregation has been shown to occur as a result of differences in the outputs of Gabor filters that operate on intensity values and as a result of the grouping of discrete elements through edge alignment and lightness similarity. Texture segregation based on these properties occurs preattentively. A second type of texture segregation appears to depend on attention. Texture segregation based on the 3D interpretation of projected shapes appears to require a focussing of attention. Attention acts to trigger texture segregation. Attention is required to see a 2D figure as

three-dimensional. The 3D interpretation is propagated in parallel or rapidly to the other figures in the pattern, and texture segregation occurs in terms of the differences in the perceived orientations off the 3D figures. A necessary condition for texture segregation is the rapid processing of stimulus differences. Texture segregation does not occur if discrimination of the relevant stimulus differences requires sequential attentional processing. GRA

**N92-28179#** Stanford Univ., CA. School of Education.

### **INDIVIDUAL DIFFERENCES IN ADAPTIVE PROCESSING IN COMPLEX LEARNING AND COGNITIVE PERFORMANCE Final Report, 1 Sep. 1989 - 30 Apr. 1991**

RICHARD E. SNOW, ROBERT L. CHASTAIN, and DOUGLAS JACKSON, III 17 Mar. 1992 23 p

(Contract AF-AFOSR-0517-89)

(AD-A248586; AFOSR-92-0260TR) Avail: NTIS HC/MF A03

Theories of intelligence and learning ability emphasize individual differences in adaptation of information processing during performance on novel, changing tasks, but measures of adaptation have been lacking. This research sought to develop and evaluate such measures in samples of Air Force recruits. Computerized tests of verbal and spatial reasoning and of spatial-perceptual-motor performance were designed to provide scores reflecting raw and residualized differences between performance in homogeneous versus heterogeneous tasks. Reference tests represented conventional ability constructs. A complex learning task based on logic gates in electronics yielded criterion scores. Reliabilities of adaptation indices were moderate, but within acceptable ranges. Low but significant correlations were obtained between some adaptation scores and some learning indices. Apparently, adaptation estimates can make a small but unique contribution to learning prediction. The research suggested further steps toward instrument improvement that seem clearly justifiable on both theoretical and practical grounds. GRA

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### **MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

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

**A92-41216** National Aeronautics and Space Administration, Washington, DC.

### **HAZARD EVALUATION AND OPERATIONAL COCKPIT DISPLAY OF GROUND-MEASURED WINDSHEAR DATA**

CRAIG WANKE and R. J. HANSMAN, JR. (MIT, Cambridge, MA) Journal of Aircraft (ISSN 0021-8669), vol. 29, no. 3, May-June 1992, p. 319-325. Research supported by MIT and FAA. Previously cited in issue 06, p. 860, Accession no. A90-19919. refs (Contract NGL-22-009-640; NAG1-690) Copyright

**A92-42031**

### **MODEL-BASED DIAGNOSIS OF A CARBON DIOXIDE REMOVAL ASSEMBLY**

DAVID R. THROOP and ETHAN A. SCARL (Boeing Computer Services, Seattle, WA) IN: Applications of artificial intelligence X: Knowledge-based systems; Proceedings of the Meeting, Orlando, FL, Apr. 22-24, 1992. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1992, p. 336-346. refs Copyright

The application of model-based diagnosis (MBD) to fluid flow-involving phenomena involving complex recycling patterns has been difficult. An account is presently given of the Space Station Freedom Carbon Dioxide Removal Assembly, which is addressed by means of the KATE constraint-based MBD shell. KATE has solved constraint sets by using external algebraic programs; attention is given to the representational challenges that arose in

the extension of KATE's previous form, as well as to the adaptations which facilitated operation within those representational limitations. C.O.

**A92-42796****COCKPIT ERGONOMICS**

YUKO NAGASAWA Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 40, no. 460, 1992, p. 259-268. In Japanese. refs

The concept of human factors engineering for pilot training and work is discussed. Pilot work load is defined and its evaluation method is analyzed. The relationship between aircraft cockpit design and human factors engineering is presented. The head up display (HUD) system, sound control, operational automation, and the pilot support system are emphasized. Y.P.Q.

**A92-43009****MEDICAL STUDY ON THE COOLING EFFECT OF THREE KINDS OF LIQUID-COOLED EQUIPMENTS**

XIANZHANG WANG, XUEYI XIAN, DAIXIA CUI, and CHENG PANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 38-45. In Chinese. refs

The cooling efficiency of three kinds of liquid-cooled equipment was investigated during physical activities and at rest in 45 deg C ambient temperature and 28 deg C dew point temperature. The results show that there were both cooling and heat-isolating effects. The cooling effectiveness of the liquid-cooled suit was the highest, that of the rest was moderate, and that of the cap was lowest. The order was reversed for cooling efficiency. When different body regions were cooled, the physiological responses were quite different. The time to reach steady skin temperature was about 1 hr longer and the skin temperature was 4 deg C lower in the chest region than in the head region. C.D.

**A92-43013****THE PROBLEM OF MATCHING SPACECRAFT CABIN ATMOSPHERE WITH SPACESUIT PRESSURE**

RUGUO ZHANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 1, May 15, 1991, p. 67-70. In Chinese. refs

Basic requirements on spacecraft cabin pressure are presented. The advantages and disadvantages of low-pressure high-concentration oxygen for astronauts are discussed. The issue of decompression sickness is addressed. Y.P.Q.

**A92-43018****MODELS OF OPERATOR BEHAVIOUR FOR CONTROLLING AND DECISION-MAKING IN MAN-MACHINE SYSTEM**

DONG-HAI LI (Tsinghua University, Beijing, People's Republic of China), ZHIFANG ZHENG, CHENGGUO HUANG (University of Science and Technology, Beijing, People's Republic of China), and CHIJUN ZHANG Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 100-108. In Chinese. refs

Several models of operator behavior for simulating human control and decision-making processes in man-machine systems are introduced. One is an optimal control model for simulating human control processes in tracing systems, a second is a fuzzy control model for analyzing human decision-making in anti-aircraft gun systems, and a third is part of an architecture for simulating control and decision-making processes in vehicle control. The formalisms and methodologies implemented in the models are described and possible applications are discussed. C.D.

**A92-43019****INVESTIGATION OF PARAMETERS FOR ERGONOMICAL DESIGNING OF ENVIRONMENTAL CONTROLLING SYSTEM IN AIRCRAFT CABIN**

JING-SHAN CHEN, SIGUANG JIA, XUEJUN YU, BAOLAN ZHANG, JINGXUE ZHANG (Institute of Space Medico-Engineering, Beijing,

People's Republic of China) et al. Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 109-115. In Chinese. refs

Tests of the effects of combined environmental stresses, including hypoxia, heat, noise, and vibration on the human body were performed in orthogonal block design. The somatic eigenstates under the combined stresses were determined by comprehensive evaluation of physiological responses. Mathematical models and nomograms for the effects were obtained using orthogonal polynomial stepwise regressive analysis, and the ergonomical design parameters were deduced. Regression diagnosis and reliability analysis indicate that the models and nomograms can be applied to system engineering design to control the combined environments in aircraft cabins. C.D.

**A92-43025****WASTE COLLECTION AND MANAGEMENT IN A MANNED SPACECRAFT**

XUE-FU SHEN and LIPING SHEN Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 2, July 31, 1991, p. 151-155. In Chinese. refs

The feces and urine collection system and waste collection and disposal system of a manned spacecraft are presented. The key technologies of the waste collection and disposal are discussed. The gas-liquid separation technology is outlined, and the ground microgravity test conditions are discussed. Y.P.Q.

**A92-43042****PHYSIOLOGICAL EVALUATION OF THE PILOT'S SURVIVAL CLOTHING FOR COLD DISTRICTS**

HUA OUYANG, HUILIANG LU, ZENGJI SHEN, JIANREN XU, ZENGREN YANG, and YUEQIN LIANG (Air Force, Institute of Aviation Medicine, Beijing, People's Republic of China) Space Medicine & Medical Engineering (ISSN 1002-0837), vol. 4, no. 4, 1991, p. 296-299. In Chinese. refs

An aluminized coat was developed to improve the survival ability of the bailed-out pilots in cold areas. Its values of insulation were determined when being worn together with winter flightsuits, and the anticold efficiency was evaluated. The results showed that the insulating value of the pilot's survival clothing for cold districts was 4.24 +/- 0.45 clo. Subjects wearing this suit were exposed to -35 C without wind for 8 h. There was no evident drop of rectal temperature. At the end of the test, average temperature of skin (Ts), average temperature of body (Tb), heat debt, skin temperatures of hands and feet all did not reach the tolerance limits. The pilot's survival clothing for cold districts satisfied pilot survival demands in cold districts of the country. Author

**A92-43111****STUDY ON A RESEARCH AND DEVELOPMENT SIMULATOR FOR PILOT CUES**

MASANARI AIBARA, T. SHINAGAWA, and MANABU HIROSE (Fuji Heavy Industries, Ltd., Tokyo, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 92-95. In Japanese. refs

A stable control evaluation for an aircraft simulator is discussed. The multifunction display of the simulator is described. Y.P.Q.

**A92-43116****STUDY ON A WORKLOAD RESEARCH SIMULATOR**

ZOJIRO KATOH, SHUJI NISHI, and YUKO NAGASAWA IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 112-115. In Japanese. refs

The pilot's operational workload evaluation research simulator (POWERS) is presented. The measurement of the workload includes: subjective opinion rating, spare mental capacity, primary task assessment, and physiological measurements. The performance, characteristics and data collection ranges of POWERS are described. Y.P.Q.

## 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

**A92-43188**

### **IN-FLIGHT SIMULATOR FOR MANUAL CONTROL TESTS OF INSTABILITY**

MASAKI KUMODA, M. KUROSU (Tokyo Metropolitan Institute of Technology, Japan), YUKICHI TSUKANO (National Aerospace Laboratory, Tokyo, Japan), and NAGAKATU KAWAHATA (Nihon University, Chiba, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 416-419. In Japanese. refs

The response feedback and explicit model following methods for control simulation are presented. The flight test of manual control of instability is discussed. The RSS aircraft fault model of the manual control system is analyzed. Y.P.Q.

**A92-43214**

### **DISPLAY EQUIPMENT AND MAN-MACHINE INTERFACE**

T. NISHIMURA (NEC Corp., Tokyo, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 520-523. In Japanese.

A man-machine interface is presented. The differences between man and machine are analyzed, such as sensing, information transmission speed, error, and soft response. The characteristics of various display systems are compared. The HUD system is addressed. Y.P.Q.

**A92-43215**

### **STUDY OF A MONITORING SYSTEM**

T. SUYAMA (Mitsubishi Electric Corp., Tokyo, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 524-527. In Japanese. refs

Man-machine interface design for an industrial plant and a large display for aiding managerial judgment are discussed. Cognitive, perceptual, and anthropometric application technologies are addressed. Y.P.Q.

**A92-43216**

### **STUDY OF A SPACE ROBOT FOR OPERATION IN ORBIT**

MITSUBISHI ODA (NASDA, Tokyo, Japan) IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 528-531. In Japanese. refs

Different types of orbital operation of a space robot are presented. Space robot structures and technology are discussed, and the issues of time delay and data communication capacity are addressed. Y.P.Q.

**A92-43223**

### **THE CHARACTERISTICS OF A LIQUID CRYSTAL FLAT PANEL DISPLAY**

C. UDAGAWA IN: Aircraft Symposium, 28th, Tokyo, Japan, Nov. 7-9, 1990, Proceedings. Tokyo, Japan Society for Aeronautical and Space Sciences, 1990, p. 556-559. In Japanese. refs

The characteristics of a liquid crystal display (LCD) are presented. A comparison between LCD and CRT is given and future tasks for LCD of the next generation are discussed. Y.P.Q.

**A92-44522\*** National Aeronautics and Space Administration, Washington, DC.

### **U.S. SPACE STATION FREEDOM WASTE GAS DISPOSAL SYSTEM TRADE STUDY**

BRIAN A. WINTERS (McDonnell Douglas Space Systems Co., Huntington Beach, CA) Journal of Propulsion and Power (ISSN 0748-4658), vol. 8, no. 4, July-Aug. 1992, p. 873-877. Research supported by NASA. Previously cited in issue 19, p. 3081, Accession no. A90-42700. refs  
Copyright

**A92-44556\*** National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

### **HOW DOES FITTS' LAW FIT POINTING AND DRAGGING?**

DOUGLAS J. GILLAN (Lockheed Engineering and Sciences Co.; Rice University, Houston, TX), KRITINA HOLDEN, SUSAN ADAM (Lockheed Engineering and Sciences Co., Houston, TX), MARIANNE RUDISILL (NASA, Johnson Space Center, Houston, TX), and LAURA MAGEE (Lockheed Engineering and Sciences Co.; Rice University, Houston, TX) CHI 90, Conference on Human Factors in Computing Systems, Seattle, WA, Apr. 1-5, 1990. 8 p. refs

(Contract NAS9-17900)

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Two experiments examined selecting text using a movement sequence of pointing and dragging. Experiment 1 showed that, in the Point-Drag sequence, the pointing time was related to the pointing distance but not to the width of the text to be selected; in contrast, pointing time was related to both the pointing distance and the width of the text in the Point-Click sequence. Experiment 2 demonstrated that both the pointing and dragging times for the Point-Drag sequence were sensitive to the height of the text that was selected. The discussion of the results centers around the application of Fitts' Law to pointing and dragging in a point-drag sequence, proposing that the target for pointing is the leftmost edge of the text to be selected, and the target for dragging is the rightmost edge of the text. Author

**A92-44677**

### **A STUDY OF SUPERMANEUVERABLE FLIGHT TRAJECTORIES THROUGH MOTION FIELD SIMULATION OF A CENTRIFUGE SIMULATOR**

D. W. REPPERGER (USAF, Armstrong Laboratory, Wright-Patterson AFB, OH) ASME, Transactions, Journal of Dynamic Systems, Measurement, and Control (ISSN 0022-0434), vol. 114, no. 2, June 1992, p. 270-277. refs

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The dynamic control of a centrifuge simulator to emulate supermaneuverable flight trajectories for high performance aircraft is studied using a centrifuge simulator. The simulator differs from traditional robots in three major aspects. It has size of 190 tons in weight and 25 feet in height but can be considered as a three revolute axes robot. The centrifuge has the same dynamic payload at all points during its dynamic operation. The centrifuge simulator is aimed at creating an unusually different motion field at a particular point on the end effector. The motion field consists of a specified linear acceleration which changes as a function of time and also a particular rotational motion field of a fixed coordinate system at the rigid body defined at the endpoint on the seat of the centrifuge where a pilot is located. O.G.

**N92-26179#** North Carolina Univ., Chapel Hill. Dept. of Computer Science.

### **ADVANCED TECHNOLOGY FOR PORTABLE PERSONAL VISUALIZATION Research Progress Report, Sep. 1990 - Mar. 1991**

FREDERICK P. BROOKS, JR. and HENRY FUCHS Mar. 1991 67 p

(Contract DAEA18-90-C-0044)

(AD-A245819) Avail: NTIS HC/MF A04

The user of a Head-Mounted Display is immersed in a computer-simulated or remotely-sensed three-dimensional world. Despite an avalanche of publicity for virtual reality in the popular press, many difficult technical problems remain unsolved for this technology, and no application of it has yet been demonstrated to be commercially viable. We believe that the hardware and software required to create high bandwidth, multi-sensory virtual worlds will in a decade be as cheap and ubiquitous, and that virtual worlds systems will be used in a variety of applications. We are therefore working on three fronts: improving the crucial hardware components required, developing a software base, and demonstrating the usefulness of this technology to solve selected real-world problems. GRA

**N92-26186#** Atomic Energy Research Inst., Daeduk (Republic of Korea).

**APPLICATION OF IRRADIATION TECHNIQUES TO FOOD AND FOODSTUFFS**

JOONG HO KWON, MYUNG WOO BYUN, SUC WON KIM, JAE SEUNG YANG, and HAN OK CHO Feb. 1991 97 p In KOREAN; ENGLISH summary  
(DE92-614952; KAERI/RR-976/90) Avail: NTIS HC/MF A05

A preservation study of dried fish, anchovies, has been conducted to determine the effect of gamma irradiation and laminated (nylon/polyethylene) film packaging on microbiological, physicochemical, and organoleptic qualities of stored samples under room, refrigeration, and freezing temperatures. Irradiation at less than 5 kGy and NY/PE-laminated film packaging are anticipated to be significantly effective for over 10 months in terms of improving the hygienic quality and extending the storage life of boiled-dried anchovies. In a survey of 700 participating consumers, respondents preferred irradiated food to chemically-treated one. However, the majority of respondents (55.7 percent) was ignorant of the fact that the Korean government and the international organizations concerned have approved the wholesomeness of irradiated food. Insufficiency of public information and understanding of irradiated food was indicated as a major cause for the retardation of the commercial utilization of food irradiation technology. In a response concerning the perception and acceptance toward irradiated food, there was a significant difference between the radiation worker and the general public.

DOE

**N92-26193\*#** RAND Corp., Santa Monica, CA.  
**HUMAN SUPPORT ISSUES AND SYSTEMS FOR THE SPACE EXPLORATION INITIATIVE: RESULTS FROM PROJECT OUTREACH**

J. AROESTY, R. ZIMMERMAN, and J. LOGAN 1991 131 p Sponsored by NASA, Washington  
(Contract F49620-86-C-0008)  
(NASA-CR-190320; NAS 1.26:190320; RAND-N-3287-AF/NASA)  
Avail: NTIS HC/MF A07

The analyses and evaluations of the Human Support panel are discussed. The Human Support panel is one of eight panels created by RAND to screen and analyze submissions to the Space Exploration Initiative (SEI) Outreach Program. Submissions to the Human Support panel were in the following areas: radiation protection; microgravity; life support systems; medical care; and human factors (behavior and performance). Author

**N92-26242#** Army Natick Labs., MA.  
**MAINTENANCE MANUAL FOR NATICK'S FOOTWEAR DATABASE Final Report, Nov. 1990 - Dec. 1991**

PAULA M. POOLE, CAROLYN K. BENSEL, and RICHARD M. ROSENSTEIN Jan. 1992 15 p  
(AD-A246273; NATICK/TR-92/015) Avail: NTIS HC/MF A03

Natick's Footwear Database is a computerized system for the management of literature regarding lower extremity health and comfort as they relate to footwear. Six major topics define the focus and the contents of the database. These are: (1) anatomy; (2) biomechanics; (3) environment; (4) footwear; (5) injury; and (6) physiology. System capabilities include: text and keyword searches of the literature in the database; presentation on the computer screen of the results of searches; and generation of printed reports of the results of searches. An entry in the database contains the complete reference, the keywords assigned, and an overall summary of the contents. In the case of a paper dealing with an experiment, summaries of the methods employed and the results of the work are also presented. This report contains detailed information regarding the operation of the maintenance version of the footwear database. Included are instructions for installing the database, adding keywords, and updating the database contents by entering new literature or modifying existing entries. GRA

**N92-26243#** Army Natick Labs., MA.  
**USER MANUAL FOR NATICK'S FOOTWEAR DATABASE Final Report, Nov. 1990 - Dec. 1991**

PAULA M. POOLE, CAROLYN K. BENSEL, and RICHARD M. ROSENSTEIN Jan. 1992 77 p  
(AD-A246275; NATICK/TR-92/016) Avail: NTIS HC/MF A05

Natick's Footwear Database is a computerized system for the management of literature regarding lower extremity health and comfort as they relate to footwear. Six major topics define the focus and the contents of the database. These are: (1) anatomy; (2) biomechanics; (3) environment; (4) footwear; (5) injury; and (6) physiology. System capabilities include: text and keyword searches of the literature in the database; presentation on the computer screen of the results of searches; and generation of printed reports of the results of searches. An entry in the database contains the complete reference, the keywords assigned, and an overall summary of the contents. In the case of a paper dealing with an experiment, summaries of the methods employed and the results of the work are also presented. This report contains detailed information regarding the operation of the user version of the footwear database. Included are instructions for installing the database, conducting text and keyword searches, and obtaining outputs from the searches. GRA

**N92-26255#** Technische Univ., Delft (Netherlands). Faculty of Mechanical Engineering and Marine Technology.

**MAN-MACHINE ASPECTS OF REMOTELY CONTROLLED SPACE MANIPULATORS Ph.D. Thesis**

JAN FRANS TONNIS BOS 1991 190 p Sponsored by Netherlands Technology Foundation  
(ISBN-90-370-0056-8; ETN-92-91291) Avail: NTIS HC/MF A09

The design of a man-machine interface for a space manipulator using the specifications for HERA (Hermes Robot Arm) is addressed. The research deals with the manual control situation. Three problems were investigated: the lack of direct vision; the control of up to six Degrees Of Freedom (DOF); and the influence of the nonlinear and slow dynamics. Results from the investigation of the use of graphical displays showed that the presence of reference enhanced the three dimensional perception, resulting in safer task execution. The use of a target frame as the reference frame for controlling the six DOF mode instead of the end effector frame was investigated. A two DOF mode was judged to be easier. Predictive displays of the stopping configuration and a trajectory are evaluated for a rough positioning task in the presence of obstacles. A preliminary investigation of the most effective length of the time-horizon was carried out. Results indicate that predictive control theory can serve as a means to describe human controller behavior. ESA

**N92-26355#** Logicon, Inc., Dayton, OH.  
**MAN-MACHINE INTERFACE ANALYSES FOR BOMBER FLIGHT MANAGEMENT SYSTEM Final Report, Jul. - Dec. 1990**

KAREN J. PEIO, ROBYN L. CRAWFORD, and GILBERT G. KUPERMAN May 1991 174 p  
(Contract F33615-89-C-0532)  
(AD-A245707; AL-TR-1991-0018) Avail: NTIS HC/MF A08

The research reported in this document represents a concept definition study directed to exploring the MMI issues inherent in the development and integration of an FM avionic subsystem into a manned, penetrating bomber weapons system. The report addresses four specific FM/MMI objectives: (1) develop and document 'optimum' FM/MMI conceptual display formats; (2) integrate a laboratory (i.e., non-flyable) software development/demonstration FM processor into DET 1 AL's Strategic Avionics Battle-Management Evaluation and Research (SABER) advanced conceptual bomber crew system simulator; (3) conduct a laboratory, part-mission demonstration of FM avionics concept in the SABER facility; and (4) provide consultative support to government and industry for review and critique of FM/MMI conceptual display formats. This report documents the initial (Concept Definition) phase of the design of 'optimum' flight management display formats. The intent is to lay the foundation for an information requirements analysis for an FM system and subsequent design of a conceptual MMI. GRA

## 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

**N92-26375#** Oak Ridge National Lab., TN.  
**LIFE SUPPORT RESEARCH AND DEVELOPMENT, A  
DEPARTMENT OF ENERGY PROGRAM FOR THE SPACE  
EXPLORATION INITIATIVE**

C. D. SCOTT, T. C. SCOTT, L. J. JOHNSON, W. W. SCHERTZ,  
and J. A. WISE (Pacific Northwest Lab., Richland, WA.) 1992  
9 p Presented at the International Conference on Life Support  
and Biospherics, Huntsville, AL, 19-20 Feb. 1992  
(Contract DE-AC05-84OR-21400)  
(DE92-007681; CONF-920263-1) Avail: NTIS HC/MF A02

The materials needed to sustain life in space operations can either be brought from Earth or created in place from wastes or in situ resources. Long-term missions of the future will require an approach in which most of the waste materials are processed and recycled and/or local resources are utilized. The concept of a Controlled Ecological Life Support System (CELSS) is under consideration for this task. Although a great amount of information exists in this area, a technical data base does not yet exist for the design of such systems. Such CELSS systems can really be considered as highly integrated physical/chemical/biological processing systems that must have very high reliability. Department of Energy (DOE) national laboratories have established a significant competence in the treatment of waste materials, especially with bioprocessing systems. Similar approaches will be used in life support R&D within the Space Exploration Initiative of the DOE. Initial research will concentrate on the processing and recycle of waste materials using microbial, enzymatic, or thermochemical processing. Other research areas will also be considered. The resulting innovative technology developed for space applications could also be the basis for important new approaches to the solution of terrestrial problems, particularly for the processing and recycle of waste materials. DOE

**N92-26472#** Defence Research Establishment, Ottawa  
(Ontario).

**EFFECT OF TEXTILE TEST SAMPLE SIZE ON ASSESSMENT  
OF PROTECTION TO SKIN FROM THERMAL RADIATION**

GEORGE A. GRANT, BRIAN H. HARRISON, and L. A. MAIN  
Oct. 1991 23 p

(AD-A246535; DREO-1096) Avail: NTIS HC/MF A03

Test samples of textile materials of 2.5, 7.6, 15.2, or 30.5 cm diameter were exposed to thermal radiation sources at Central Receiver Test Facility and the Thermal Radiation Source at Kirtland Air Force Base, New Mexico. The materials were exposed to fluences of 5, 10, 15, and 30 cal/sq. cm. in 1 or 3 seconds. The thermal pulse was square or approximately that of 1 KT weapon. Generally, damage to materials increased with an increase in the test sample (30.5 cm) ignited prior to 2.5 cm diameter samples. It was evident that testing with small samples of material would over-estimate the protection afforded. Comparison of test results of materials exposed to simulated and non-simulated nuclear weapons support the conclusion that protection is over-estimated by assessment of damage on exposed small test samples. GRA

**N92-26494#** Oak Ridge National Lab., TN.  
**LIFE SUPPORT RESEARCH AND DEVELOPMENT FOR THE  
DEPARTMENT OF ENERGY SPACE EXPLORATION  
INITIATIVE**

CHARLES D. SCOTT, LAMAR J. JOHNSON, WILLIAM W.  
SCHERTZ, JAMES A. WISE (Pacific Northwest Lab., Richland,  
WA.), and CHARLES E. WYMAN 1992 6 p  
(Contract DE-AC05-84OR-21400; W-31-109-ENG-38;  
DE-AC02-83CH-10093; DE-AC07-76ID-01570)  
(DE92-007239; CONF-920473-1) Avail: NTIS HC/MF A02

Long-term, manned space missions of the future will require an approach to life support systems in which most of the waste materials must be processed and recycled and/or local resources are utilized. The requirement for a reliable life support system has been recognized as an important component of the Space Exploration Initiative, and the Department of Energy (DOE), in conjunction with the National Aeronautics and Space Agency, is organizing a program in support of the development of this type of technology. It is quite likely that bioprocesses will be important

components of the integrated system, and this will be the primary area of R&D within the DOE national laboratories. Initial research will include investigation of microbial, enzymatic, and thermochemical processing of wastes. Other research areas of interest include water and air purification by plants, microbial detection systems, biophotochemical CO<sub>2</sub> recycle, tissue cultures for food, single-cell protein, bioadsorbents for pollutant removal, and several others. The resulting innovative technology developed for space exploration could also be the basis for new approaches for the processing and recycle of waste materials on Earth. DOE

**N92-26528#** Aerospace Medical Research Labs., Brooks AFB,  
TX.

**THE ELECTRONIC EVALUATION OF THE ADVANCED  
DYNAMIC ANTHROPOMORPHIC MANIKIN (ADAM) IN HIGH  
TEMPERATURE ENVIRONMENTS Final Report, Apr. 1990 -  
Mar. 1991**

ERIC K. SPITTLE, ROY R. RASMUSSEN, and INTS KALEPS Mar.  
1991 9 p  
(Contract AF PROJ. 7231)

(AD-A245459; AL-TR-1991-0079) Avail: NTIS HC/MF A02

From the results of the 987 tests, it is concluded that the ADAM may have difficulty operating in high ambient temperatures above 160 F. The tests described in this report were used to determine probable causes of manikin shutdown at temperatures above this range. The safe viscera operational temperature threshold was determined to be 180 F. This correlates to a safe ambient operations temperature threshold of 130 F with a worst case manikin set up. To determine when the ADAM shut down above this temperature, manikin internal load cells, potentiometers, and accelerometers were excited and monitored external to the manikin. Additionally, circuit board voltages were externally monitored to determine when and which circuit boards shut down during a test. Finally, data were collected from the ADAM periodically to monitor the operational status of the manikin and any effect the temperatures were having on the sensors and data acquisition system of the manikin. The temperature profiles selected were representative of the operational temperatures the ADAM will experience in the F-16 cockpit mockup on the Multi-Axis Seat Ejection (MASE) sled, where the ADAM will be used for ejection tests in the near future. GRA

**N92-26538\*#** National Aeronautics and Space Administration.  
Lyndon B. Johnson Space Center, Houston, TX.

**THE VALIDATION OF A HUMAN FORCE MODEL TO PREDICT  
DYNAMIC FORCES RESULTING FROM MULTI-JOINT  
MOTIONS**

ABHILASH K. PANDYA, JAMES C. MAIDA, ANN M. ALDRIDGE,  
SCOTT M. HASSON (Texas Womens Univ. Research Inst.,  
Denton.), and BARBARA J. WOOLFORD Jun. 1992 33 p  
(Contract NAS9-17900)  
(NASA-TP-3206; S-670; NAS 1.60:3206) Avail: NTIS HC/MF  
A03

The development and validation is examined of a dynamic strength model for humans. This model is based on empirical data. The shoulder, elbow, and wrist joints were characterized in terms of maximum isolated torque, or position and velocity, in all rotational planes. This data was reduced by a least squares regression technique into a table of single variable second degree polynomial equations determining torque as a function of position and velocity. The isolated joint torque equations were then used to compute forces resulting from a composite motion, in this case, a ratchet wrench push and pull operation. A comparison of the predicted results of the model with the actual measured values for the composite motion indicates that forces derived from a composite motion of joints (ratcheting) can be predicted from isolated joint measures. Calculated T values comparing model versus measured values for 14 subjects were well within the statistically acceptable limits and regression analysis revealed coefficient of variation between actual and measured to be within 0.72 and 0.80. Author

**N92-26665#** Naval Medical Research Inst., Bethesda, MD.  
**PHYSIOLOGICAL DESIGN GOALS AND PROPOSED THERMAL LIMITS FOR US NAVY THERMAL GARMENTS: PROCEEDINGS OF 2 CONFERENCES SPONSORED BY THE NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND Technical Report, Jul. 1976 - Sep. 1980**

PAUL W. WEBB, E. L. BECKMAN, PHILIP SEXTON, and W. S. VAUGHN Nov. 1991 51 p Conference No. 1 on Proposed Thermal Limits for Divers: A Guide for the Designers of Thermally Protective Equipment held July 1976; Conference No. 2 on Physiological Design Goals for Thermal Protection of Divers held Sep. 1980

(Contract N00014-72-C-0057; N00014-80-C-0193)  
 (AD-A245543; NMRI-91-85) Avail: NTIS HC/MF A04

The proceedings of two conferences that were held to develop physiological limits and design goals for passive thermal garments are presented. These proceedings have not been achieved in the literature, but were in the form of reports submitted to the Office of Naval Research and Naval Medical Research and Development Command. This technical report has been published solely to archive these proceedings, which are of historic value. The first proceeding is entitled 'Proposed Thermal Limits for Divers: A Guide for Designers of Thermally Protective Equipment', held in July 1976. This proceeding sets the physiologic limits for both cold and heat exposure within which protective gear must maintain individuals. Total body and respiratory heat loss, core temperature, skin temperature, and hand and foot limits are discussed. A section on performance factors is also given. GRA

**N92-26682\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**CORRELATION AND PREDICTION OF DYNAMIC HUMAN ISOLATED JOINT STRENGTH FROM LEAN BODY MASS**

ABHILASH K. PANDYA, SCOTT M. HASSON, ANN M. ALDRIDGE (Lockheed Engineering and Sciences Co., Houston, TX.), JAMES C. MAIDA, and BARBARA J. WOOLFORD Jun. 1992 64 p (Contract NAS9-17900)

(NASA-TP-3207; S-671; NAS 1.60:3207) Avail: NTIS HC/MF A04

A relationship between a person's lean body mass and the amount of maximum torque that can be produced with each isolated joint of the upper extremity was investigated. The maximum dynamic isolated joint torque (upper extremity) on 14 subjects was collected using a dynamometer multi-joint testing unit. These data were reduced to a table of coefficients of second degree polynomials, computed using a least squares regression method. All the coefficients were then organized into look-up tables, a compact and convenient storage/retrieval mechanism for the data set. Data from each joint, direction and velocity, were normalized with respect to that joint's average and merged into files (one for each curve for a particular joint). Regression was performed on each one of these files to derive a table of normalized population curve coefficients for each joint axis, direction, and velocity. In addition, a regression table which included all upper extremity joints was built which related average torque to lean body mass for an individual. These two tables are the basis of the regression model which allows the prediction of dynamic isolated joint torques from an individual's lean body mass. Author

**N92-26891#** Institute of Sound and Vibration Research, Southampton (England).

**DESIGN GUIDE FOR SADDLE SEATING ON SMALL HIGH-SPEED CRAFT**

A. J. MESSENGER and M. J. GRIFFIN Feb. 1992 19 p Sponsored in part by Inst. of Naval Medicine, Ministry of Defence (Navy), Alverstoke, England

(ISVR-TR-205) Avail: NTIS HC/MF A03

This design guide gives recommendations for the design of saddle-type seating fitted in small high-speed craft. Recommendations are made for the dimensions, angles, contouring and padding of the seat pan and backrest. Body depth and lateral space clearances are also considered, as are the positioning and dimensions of toe-straps and hand-holds. The recommendations

are based on the principle of matching seat dimensions to the relevant dimensions of the user population so as to minimize passenger discomfort and reduce fatigue caused by inappropriate sitting postures. The dimensions suggested are appropriate for British males aged between 19 and 45 years. The anthropometric dimensions and population percentile values used in recommending each dimension are also specified so that the given values can be replaced by those appropriate to a different user population. The rationale behind the suggested dimensions and the consequences of deviating from the recommended values are specified. Author

**N92-26950#** European Space Agency, Paris (France).

**FOURTH EUROPEAN SYMPOSIUM ON SPACE ENVIRONMENT CONTROL SYSTEMS, VOLUME 2**

T.-DUC GUYENNE, ed. and JAMES J. HUNT, ed. Dec. 1991 526 p In ENGLISH and FRENCH Symposium held in Florence, Italy, 21-24 Oct. 1991

(ESA-SP-324-VOL-2; ISBN-92-9092-138-2; ETN-92-91356) Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Papers of the fourth European symposium on space environmental control systems covering activities on space thermal control life support and habitability are presented. The subjects covered, range from cryogenic cooling to reentry thermal protection systems, from atmosphere management to water and waste management, and from internal architecture to astronaut food selection. In volume 2, the following topics are addressed: water management, computational environment, heat rejection, instrument and equipment thermal control, Controlled Ecological Life Support Systems (CELSS), cooling loop components, habitability, in orbit thermal performance, extravehicular activity, thermal protection streams, architecture, and interior design. ESA

**N92-26951#** Nauchno-Proizvodstvennoe Obedinenie Niichimmash, Moscow (USSR).

**WATER RECOVERY FROM CONDENSATE OF CREW RESPIRATION PRODUCTS ABOARD THE SPACE STATION**

N. M. SAMSONOV, N. S. FARAFONOV, V. M. NOVIKOV, L. S. BOBE, V. M. GORDEYEV, G. K. ABRAMOV, N. N. PROTASOV, J. E. SINJAK, I. V. LAVROV (Nauchno-Proizvodstvennoe Obedinenie Energija, Kaliningrad, USSR), P. I. GLUSHENKO et al. In ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 625-627 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The process and equipment for water recovery from condensate derived from atmosphere thermal/moisture control facilities of the long endurance Mir manned Space Station are considered. The recovery process includes the reception and separation of liquid from the gas/liquid stream, water purification from contaminants, purified water saturation with food salts, and preservation to prevent the growth of microflora. Low energy processes and equipment for the system in zero gravity space flight are discussed. The recovery system is currently in operation aboard the orbital space station Mir. The energy requirements for recovered water (without water preheating on ingestion) and the specific weight of equipment are 4 W hr and 0.2 kg per kg of recovered water with about 100 percent of water recovery from condensate feed, and the quality conforming to the relevant standard. With the minor modification, the system may be used for future orbital space stations of new generation, Mars spaceships, and lunar bases. ESA

**N92-26952#** Nauchno-Proizvodstvennoe Obedinenie Niichimmash, Moscow (USSR).

**WATER RECLAMATION FROM URINE ABOARD THE SPACE STATION**

N. M. SAMSONOV, V. M. NOVIKOV, L. S. BOBE, B. J. PINSKI, V. A. LEONOV, N. N. PROTASOV, V. V. KOMOLOV, V. B. FILONENKO (Nauchno-Proizvodstvennoe Obedinenie Vniigidromash, Moscow, USSR), and S. S. BOCHAROV In ESA, 4th European Symposium on Space Environmental Control

Systems, Volume 2 p 629-631 Dec. 1991  
 Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A system designed for water reclamation from urine by atmospheric distillation with condensate sorption post treatment is considered. A schematic process diagram and a system operation sequence are described. Some research and engineering problems relating to the development of equipment for the orbital Space Station are outlined. A process for water evaporation from solution into a vapor/gas fluid at the surface restricted by a capillary/porous hydrophilic selective membrane which ensures the process performance at zero gravity is analyzed. Some results of the operation of the system aboard the Soviet orbital Space Station Mir are discussed. The effectiveness and promise for water reclamation systems aboard the current and future Space Stations are shown. For long endurance orbital Space Stations, the most effective method is to reclaim water from urine. The reclaimed water is used as potable water and for food preparation (after additional conditioning) or for producing electrolyzed O<sub>2</sub>. The latter can fully provide the crew with simulated atmosphere for breathing. ESA

**N92-26953\*#** Boeing Co., Houston, TX. Defense and Space Group.

**SPACE STATION FREEDOM REGENERATIVE WATER RECOVERY SYSTEM CONFIGURATION SELECTION**

R. REYSA and J. EDWARDS /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 633-642 Dec. 1991

(Contract NAS8-50000)

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The Space Station Freedom (SSF) must recover water from various waste water sources to reduce 90 day water resupply demands for a four/eight person crew. The water recovery system options considered are summarized together with system configuration merits and demerits, resource advantages and disadvantages, and water quality considerations used to select the SSF water recovery system. ESA

**N92-26954#** Niigata Univ. (Japan). Faculty of Engineering.  
**CATALYTIC WET-OXIDATION OF HUMAN WASTE PRODUCED IN A SPACE HABITAT: PURIFICATION OF THE OXIDIZED LIQUOR FOR HUMAN DRINKING**

Y. TAKAHASHI, N. TAKEDA, T. AOYAGI, and K. TANAKA /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 643-647 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

In order to elucidate the reproducibility and durability of the Ru-Rh catalyst developed formerly for wet oxidation, the filtrate of noncatalytically wet oxidized sewage sludge was wet oxidized again at 300 C using the catalyst. This test was carried out as a batch one and repeated 32 times using only one catalyst. Almost complete oxidation and denitrification occurred regardless of the repetition number. The reproducibility and durability of the catalyst was ensured. In order to reuse the product of the catalytic wet oxidation for hygiene and/or potable water, it was treated by granulated activated carbon and ion exchange resin. Organic matter, conductivity, and color was removed effectively to the levels of potable water. The catalytically wet oxidized liquor can be reused at least for hygiene water. The reuse of potable water is also promising. ESA

**N92-26955#** Nauchno-Proizvodstvennoe Obedinenie Niichimmash, Moscow (USSR).

**HYGIENE WATER RECOVERY ABOARD THE SPACE STATION**  
 N. M. SAMSONOV, N. S. FARAFONOV, L. K. ABRAMOV, S. S. BOCHAROV, N. N. PROTASOV, V. V. KOMOLOV, V. B. FILONENKO, and A. A. BERLIN (Institute of Biomedical Problems, Moscow, USSR) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 649-651 Dec.

1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The system for hygiene water recovery, which is currently in operation aboard the orbital Space Station Mir, is considered. The system receives untreated hygiene water as a water/air mixture from the handwash and shower facilities, separates the mixture phases, stores untreated water, purifies water from mechanical and dissolved impurities, decontaminates and stores purified water, and preheats and feeds purified water to the handwash and shower facilities. A schematic of the system is presented. The operations of the system, the method of water recovery, and design of main blocks are described. The ways of system updating are illustrated. The energy/mass characteristics of the system supporting the evidence of effectiveness of the system aboard the long term orbital space stations are listed. ESA

**N92-26956#** Kiev Polytechnic (USSR).  
**THE CENTRIFUGAL MASS EXCHANGE APPARATUS IN AIR-CONDITIONING SYSTEM OF ISOLATED, INHABITED OBJECT AND ITS WORK CONTROL**

P. A. BARABASH, V. G. RIFERT, L. S. BOBE, N. N. GOLIYAD, and V. B. FILONENKO (Nauchno-Proizvodstvennoe Obedinenie Vniigidromash, Moscow, USSR) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 653-658 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The results of the research conducted in the hydrodynamic and heat and mass transfer processes taking place in separators-distillers are obtained, and recommendations for the design and manufacture of the equipment are given. A tradeoff analysis of several known methods of measuring the small concentrations of gas inclusions in liquids and aerosols is conducted, and, on the basis of this analysis, the integral method of light dispersion is chosen for implementation. ESA

**N92-26957#** National Space Development Agency, Tokyo (Japan).

**DESIGN OF JEM TEMPERATURE AND HUMIDITY CONTROL SYSTEM**

TADASHI SUZUKI, SYOZO SHIBUTANI, AKIRA HATTORI, SABUROU MIWA, and MASAHARU TAKAGISHI (Kawasaki Heavy Industries Ltd., Gifu, Japan) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 659-664 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The design of the Japanese Experiment Module (JEM) to be attached to the Columbus Space Station is addressed. Environmental requirements for two crew members in the module are outlined. The design status of JEM Temperature and Humidity Control (THC) subsystem is described. Design requirements derived from the whole JEM system design are introduced. The THC subsystem and the THC assembly design are presented. Some test results in cabin ventilation testing and component testing are outlined. ESA

**N92-26980\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**IMPACT OF DIET ON THE DESIGN OF WASTE PROCESSORS IN CELSS**

AHMAD WALEH, VALERY KANEVSKY, THOI K. NGUYEN, RAVI UPADHYE (Lawrence Livermore National Lab., CA.), and THEODORE WYDEVEN /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 817-821 Dec. 1991

(Contract NAS2-13260)

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The preliminary results of a design analysis for a waste processor which employs existing technologies and takes into account the constraints of human diet are presented. The impact

of diet is determined by using a model and an algorithm developed for the control and management of diet in a Controlled Ecological Life Support System (CELSS). A material and energy balance model for thermal oxidation of waste is developed which is consistent with both physical/chemical methods of incineration and supercritical water oxidation. The two models yield quantitative analysis of the diet and waste streams and the specific design parameters for waste processors, respectively. The results demonstrate that existing technologies can meet the demands of waste processing, but the choice and design of the processors or processing methods will be sensitive to the constraints of diet. The numerical examples are chosen to display the nature and extent of the gap in the available experiment information about CELSS requirements. ESA

**N92-26981#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

**MELISSA: PHYSICAL LINKS OF COMPARTMENTS NITROBACTER/SPIRULINA**

C. LASSEUR, R. A. BINOT (MATRA Espace, Paris-Velizy, France), C. TAMPONNET, and J. F. CORNET *In its* 4th European Symposium on Space Environmental Control Systems, Volume 2 p 823-829 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The MELISSA (Micro Ecological Life Support System Alternative) project, conceived as a microorganism based ecosystem, is preparing an early, simplified, model of a future biological life support system for planned space missions. The preparation of the physical linkage of the nitrification and photosynthetic compartments is presented. These two compartments are representative at the control level (cascade between two compartments and feed back on the gas phase) and at the technological level (low and high biomass production, immobilization, culture medium recycling, gas transfer, etc.). The general requirements applicable to all the compartments of the loop are presented and the specific requirements of the above two are described. The first technologies selected and first results obtained are presented. Advantages and weaknesses of the actual design and the development planned for the future is presented. ESA

**N92-26983#** Bioclear Environmental Biotechnology, Groningen (Netherlands).

**BIODEGRADATION STUDIES WITH SPACE CABIN CONTAMINANTS TO DETERMINE THE FEASIBILITY OF BIOLOGICAL AIR FILTRATION (BAF) IN SPACE CABINS**

S. KEUNING, D. JAGER, P. G. PAUL, and R. A. BINOT (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 837-841 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The development of a Biological Air Filter (BAF), a biologically based and self regenerable device for trace contaminant removal in space cabins, is considered. The efficient operation of a BAF is largely dependent on the kinetic properties of the microbial community of 'biocatalyst' in the biofilter device. In a biological air filter a variety of chemical compounds have to be degraded by a mixed population of microorganisms with different degradation capacities. Such a system is rather complex with many interaction effects. To investigate these effects and determine kinetic properties biodegradation experiments were performed with pure and mixed bacterial cultures in which the number of contaminants and of bacterial strains with specific degradation capabilities were gradually increased. A significant positive influence of cultivating on mixed substrated was observed. A complex culture composed of up to six different strains efficiently degraded a mixture of six different organic compounds and remained stable over a long period. The results of the biodegradation studies obtained so far

show good prospectives for the applicability of biological air filtration during manned space missions. ESA

**N92-26984#** Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.).

**PROGRESS IN THE DEVELOPMENT OF THE HERMES EVAPORATORS**

C. GOEHRE, R. BOHLEN, B. J. G. LEIDINGER, R. MUELLER, P. MUELLER-REMMERS, and R. ROHR *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 845-850 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The results of the first development approaches of the three evaporators for the Hermes Spaceplane, used for rejecting waste heat, are presented: the Water Evaporator Assembly (WEA), the Ammonia Boiler Assembly (ABA) and the Hydraulic Thermal Control Assembly (HTCA). Some important development activities, in particular tests of the technology demonstration models for WEA and ABA, are summarized. Tests with these first evaporator prototypes of WEA and ABA showed that the requirements for the flight unit can be met and certain problems have to be solved. On HTA, sample tests are envisaged up to now. ESA

**N92-26989#** Aerospatiale, Les Mureaux (France). Strategic and Space System Div.

**HUMAN FACTORS IN THE CONCEPTION OF THE HERMES SPACE VEHICLE**

F. WINISDOERFFER *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 883-892 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The status of the habitability studies performed during the course of the development of the Hermes space vehicle in terms of functions to be fulfilled is presented. Based on crew role definition and scenario, usage analysis was performed through computer simulations and full scale testing in 1 g and neutral buoyancy conditions, to specify and to verify the adequacy of the configuration with respect to its utilization by the crew. Some results of these usage analyses are presented in terms of human factors engineering, design rules and requirements that will enable the system and subsystem designers to efficiently take into account the presence of man on board at an early stage of the definition. This process is aimed at enhancing the 'vehicle/man fit' that will greatly contribute to the overall mission success. ESA

**N92-26991#** Alenia Spazio S.p.A., Turin (Italy).

**CAD SYSTEM FOR HFE ANALYSES: ZERO-G POSTURE IN OPTIMISATION OF COLUMBUS APM CREW WORKSTATIONS**

FABIANA BOBBA, PIER LUIGI GIORGI, and ENRICO GAIA *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 899-904 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A comparison between the required and the preferred (neutral) workstation posture of the human body in microgravity is made. This analysis is supported by tridimensional modelization via Computer Aided Design (CAD). The software simulation tool is capable of faithfully reproducing the internal Attached Pressurized Module (APM) environment and human models. From this comparison a validation of the considered workstation configuration follow, together with suggestions useful when design modifications are required in order to meet the Human Factors Engineering (HFE) requirements and to allow the performance of crew tasks with high efficiency and comfort. Two humans models were created for the analysis via the CAD system on the basis of the anthropometric data established by referring to a 95th percentile American male and a 5th percentile Japanese female. The most representative working areas are analyzed: module control station, viewport, airlock, and standoff portions. ESA

**N92-26993#** Alenia Spazio S.p.A., Turin (Italy).  
**CREW SUPPORT EQUIPMENT: IDENTIFICATION AND  
 DEFINITION OF ADDITIONAL HARDWARE FOR COLUMBUS  
 APM LABORATORY HABITABILITY**

SIMONA FERRARIS, GIORGIO MUSSO, and ENRICO GAIA *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 911-916 Dec. 1991  
 Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Habitability problems for the design of the Columbus APM (Attached Pressurized Module) are addressed. All equipment required to support the crew is identified from analysis of the following: crew and equipment stability/mobility aids; interior design; activity aids. A design definition concept is proposed for each item according to criteria of efficiency, reliability, easy usability, minimization of weights and volumes, and where possible, standardization. ESA

**N92-26994#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

**MICROGRAVITY SIMULATION**  
 K. VERGE-DEPRE *In its* 4th European Symposium on Space Environmental Control Systems, Volume 2 p 917-921 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Microgravity simulation facilities such as 'parabolic flights and neutral buoyancy facility' developed to perform microgravity studies were analyzed. The analysis of constraints related to microgravity simulation facilities emphasized the strong and weak points of each environment in terms of microgravity effects on task reliability, result validity, etc. The microgravity simulation facilities are described and the type of information which could be extracted is defined. ESA

**N92-26995#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Columbus Crew Activities and On-Board Payload Operations.

**ENGINEERING OF A NEW OVERALL SYSTEM TO IMPROVE  
 THE INTERACTION BETWEEN THE CREW AND THE  
 GROUND-BASED SCIENTISTS AND PERSONNEL**

CARLO VIBERTI *In its* 4th European Symposium on Space Environmental Control Systems, Volume 2 p 923-928 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A system to optimize efficiency and flexibility of onboard crew tasks is described. The basic idea consists of moving all the payload related and some payload to system related control functions from what is normally a fixed control station to a portable computer and a portable terminal, thus allowing interaction with various experimental equipment without being constrained by strict system software requirements. An overview of the technological features of such a system concept is given. ESA

**N92-27002#** Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).

**EVA LIFE SUPPORT DESIGN AND TECHNOLOGY  
 DEVELOPMENTS**

R. VAETH and A. I. SKOOG *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 971-983 Dec. 1991 Sponsored by ESA

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The technology development activities for the Extra Vehicular Activity (EVA) life support system within the framework of the ESA initiated EVA space suit system development program was completed as part of the predevelopment Phase C1. The achieved results and the progressing of the system design work resulted in an enhanced life support system design concept for the start of Phase C/D. While working towards an improved concept with

respect to the main design drivers mass and cost, the technical concept was improved with respect to functional safety and ease of handling. The design concept status for Phase C/D and the results of the predevelopment of critical technologies for the EVA life support system are provided. The results of the investigations on breadboard model level and the design implications are analyzed. ESA

**N92-27003#** Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

**GENESIS AND EVALUATION OF AN ERGONOMIC  
 ARCHITECTURE FOR THE ESA EVA SUIT**

Y. OLLIVIER, C. MANDIN, and M. DIENER (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.) *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 985-990 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Few complex systems are closed to the human body and so constrained by human factors than the Extra Vehicular Activity (EVA) spacesuit. At the beginning of development analysis/test/development methods are necessary in order to insure the required human performances. Such methods are illustrated by the EVA phase 1/subphase C1 suit demonstrator development and tests, the purpose of which is to perform key technological assessments at subsystem level before starting the design of a fully representative development model. The main steps of this ergonomic oriented approach consist basically of parametric studies, computer aided design ergonomic simulations, 'man in the loop' evaluations; they are the following: from actional analysis to suit sections ergonomic performances; theoretical determination of the suit ergonomic architecture; mock up evaluations and suit ergonomic architecture refinement ergonomic test of the suit demonstrator. The purpose and the definition of these steps are described and the main results obtained for the suit enclosure during the C1 phase are provided. ESA

**N92-27004#** Alenia Spazio S.p.A., Turin (Italy).

**EVA SPACE SUIT THERMAL CONTROL AND  
 MICROMETEOROID PROTECTION**

MARIA CRISTINA TOSI, GIANLUIGI GERA, and ANTONIO MOSCATELLI *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 991-998 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The Extra Vehicular Activity (EVA) space suit item necessary to guarantee the thermal control and micrometeoroid protection functions is the Thermal and Micrometeoroid Protection (TMP), covering the whole body of the crewmember and the EVA suit back pack. A comprehensive analysis of the materials, configuration research and screening is presented, showing the compliance with the requirements. The preferred baseline design solution to be applied to the manufacturing of the breadboard TMP arm is also described. The dedicated technology program, including a thermal vacuum test developed to demonstrate the thermal capability of the EVA space suit breadboard TMP arm, is also discussed. ESA

**N92-27005#** Zodiac Espanola S.A., Figueras (Spain).

**DEVELOPMENT OF THE SUIT ENCLOSURE SOFT JOINTS OF  
 THE EUROPEAN EVA SPACE SUIT**

V. MENENDEZ and Y. OLLIVIER (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France) *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 999-1004 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Results of efforts carried out for the definition, design, development, manufacturing and testing of an Extra Vehicular Activity (EVA) space suit soft joint breadboard operating at 500 hPa are described. The Suit Enclosure Subsystem (SES) will be able to provide the astronaut with the test protection against the

environment while providing him with the best mobility. The driving parameter of this optimization is the suit internal pressure established at 500 hPa as the goal value for the suit design. The elbow was chosen as the SES soft joint representative to assess, through a breadboard evaluation, the feasibility and performance. The elbow joint was evaluated but also the adjustment devices and the representative interface to validate the related selected concepts. In addition to the elbow joint breadboard, a test bench allowing a complete evaluation of the breadboard was designed and manufactured. A description of the breadboard and the test bench is given and the main results of the evaluation are presented. ESA

**N92-27006#** Technofan, Blagnac (France). Labinal Group.  
**FAN/PUMP/SEPARATOR TECHNOLOGY DEVELOPMENT FOR EVA**

J. M. LASSUS, V. BOITEL, B. MERCHIE, J. WITT, S. KLINGELE, and H. FUNKE (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.) *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1005-1010 Dec. 1991 Sponsored by ESA

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Concept tradeoffs and design definitions have confirmed the gain in power, mass and volume achieved by integrating all three functions into a single unit, driven by one common brushless DC motor at 8150 rpm. The performance requirements for the three basic functions (oxygen and coolant water circulation and water separation) were derived from the layout of the life support system for the European Extra Vehicular Activity (EVA) space suit system. The functional units were studied and developed separately before final assembly of the integrated breadboard, which was successfully tested. The development approach, the concept selection, the design and tests results are described. A special water pump design with an integrated 'degassing device' was proposed. Corresponding investigations are presented. ESA

**N92-27007#** Nuevas Tecnologias Espaciales S.A., Lissa d'Amunt (Spain).

**STUDY ON THE REQUIREMENTS FOR THE INSTALLATION OF A CES AND HABITABILITY CENTRE**

A. TOMAS, G. MONSERRAT, and M. PASTOR *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1013-1019 Dec. 1991 Sponsored by ESA and Spanish Space Delegation

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The need for a center carrying out research activities and technological developments in Closed Ecological Systems (CES) and habitability, as interrelated disciplines when studying life support systems, is pointed out by presenting a list of problems to be solved in space and terrestrial applications. A summary of present developments in the discipline is given and a tentative description for a center is presented, identifying the different functional areas and giving figures of surface and power for these areas. Requirements for the center placement are also suggested. Elements for establishing a schedule for center construction and operations are presented by analyzing the planned space programs and expected terrestrial spin offs. ESA

**N92-27009#** Texas Southern Univ., Houston.  
**AN EVALUATIVE STUDY OF THE SENSORY QUALITIES OF SELECTED EUROPEAN AND ASIAN FOODS FOR INTERNATIONAL SPACE MISSIONS (A FRENCH FOOD STUDY)**

S. AHMED and P. V. CORNISH *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1025-1030 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

European and Asian foods for international space missions were investigated by evaluating sensory qualities. Selected Russian, French, Japanese foods were prepared and evaluated by a taste

panel for acceptability. Entrees, soups, desserts, vegetables, salads, beverages and snacks were evaluated on the basis of appearance, odor, favor and texture. Food samples were scored on a nine point hedonic scale. The result for the food samples comparatively studied showed significant differences between quality characteristics, foodtypes and compared groups (trained panelist and ethnic panelists) for the Russian and French food samples. The Japanese food samples indicated a significant difference between quality characteristics only at the 0.10 confidence level. Japanese foodtypes and compared groups were significantly different at the 0.05 confidence level. As a result of this study, forty three Russian, thirty five French, and thirty seven Japanese foods were identified as possible candidates for international space missions. ESA

**N92-27010#** CJB Developments Ltd., Portsmouth (England).  
**CRITICAL TECHNOLOGIES: SPACECRAFT HABITABILITY, AN UPDATE**

R. A. J. DAMS *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1031-1036 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A study to identify critical technologies relating to spacecraft habitability was performed. Five technologies were identified which were worthy of continuous study because of their magnitude or because it was considered continuous updating of latest terrestrial developments was required. These 'ongoing' technologies were: new methods of food processing and new kinds of space food; space motion sickness, identifying prevention; radiation, acceptable life time limits; provision of artificial gravity; habitation mockup. Latest developments in these technologies, both in space and on Earth are reviewed. ESA

**N92-27017#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

**DETERMINATION OF VENTILATION REQUIREMENTS FOR A SPACE SUIT HELMET**

J. WITT and R. SEURIG *In* its 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1081-1085 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Tests were carried out to study the ventilation in a space suit helmet representative of the European space suit system. Visor fogging and CO<sub>2</sub> exposure were determined at different ventilation flow rates, inlet conditions and metabolic rates. Different configurations at the inlet duct for the ventilation of the helmet were tested. A mockup of the hard upper torso and a breathing manikin able to simulate the CO<sub>2</sub> and humidity production of an astronaut performing extravehicular activity were designed and built. Test results are presented and discussed. ESA

**N92-27018#** Nord-Micro Elektronik Feinmechanik G.m.b.H., Frankfurt (Germany, F.R.).

**DEVELOPMENT OF EUROPEAN SUBLIMATOR TECHNOLOGY FOR EVA**

CHRISTINE PLANERT, PETER KREMER, VOLKER GENERAL, and JOHANNES WITT (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1087-1091 Dec. 1991 Sponsored by Dornier G.m.b.H.

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Temperature and humidity control are important functions for the astronaut's comfort and safety in an Extra Vehicular Activity (EVA) space suit. Several sources within the suit are permanently producing heat and humidity; both have to be removed to prevent visor fogging and overheating of the astronaut. In the European space suit heat will be removed by using the transformation of ice into vapor in vacuum (sublimation process). In the sublimator

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this process will take place in a porous plate, which is mounted onto a liquid gas heat exchanger. A breadboard unit was manufactured from stainless steel and a new porous plate was developed. Performance tests demonstrated the technical feasibility of the design concept. Results obtained during manufacturing and testing of the European sublimator breadboard are presented.

ESA

### **N92-27019# Draegerwerk A.G., Luebeck (Germany, F.R.). INVESTIGATION ON A PARTIAL PRESSURE CARBON DIOXIDE SENSOR**

K. AMMANN and J. WITT (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands ) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1093-1098 Dec. 1991 Sponsored by ESA/ESTEC  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A summary of a technology research program aimed at the development of a CO<sub>2</sub> partial pressure sensor suitable for monitoring the ppCO<sub>2</sub> inside the oxygen ventilation loop of the extravehicular activity life support module is given. Tradeoffs of candidate sensor concepts are presented. As result, the infrared optical sensor concept was selected. A breadboard model of the ppCO<sub>2</sub> sensor together with a test set up was established. The sensor was subjected to a test program and main results are given. The findings are discussed in the light of the development of future flight hardware.

ESA

### **N92-27020# AiResearch Mfg. Co., Torrance, CA. HEAT REJECTION SYSTEM FOR AN ADVANCED EXTRAVEHICULAR MOBILITY UNIT PORTABLE LIFE SUPPORT SYSTEM**

HAL J. STRUMPF and A. A. VUIGNER /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1099-1106 Dec. 1991  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A study is being conducted on the design, development, fabrication, integration, and testing of subsystems for an advanced extravehicular mobility unit Portable Life Support System (PLSS). A subsystem, the Heat Rejection System (HRS), is discussed. The function of the HRS is to remove metabolic and equipment heat loads and provide a comfortable thermal environment for a crew person during extravehicular activity. Two versions of the HRS were studied. The first version is discussed. It comprises a Regenerable Nonventing Thermal Sink (RNTS). The RNTS consists of cold plate heat exchangers, a radiator to reject a fraction of the generated heat load, and a regenerable thermal storage unit to absorb the remaining heat load. The second version of the HRS, not discussed, comprises a radiator (with no thermal storage) and a vented water evaporator.

ESA

### **N92-27021\*# AiResearch Mfg. Co., Torrance, CA. METAL OXIDE ABSORBENTS FOR REGENERATIVE CARBON DIOXIDE AND WATER VAPOR REMOVAL FOR ADVANCED PORTABLE LIFE SUPPORT SYSTEMS**

JOAN M. HART, JOSEPH B. BORGHESE, CRAIG H. CHANG, and GREG T. STONESIFER (Lockheed Engineering and Sciences Co., Moffett Field, CA.) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1107-1111 Dec. 1991  
(Contract NAS9-17900)  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Recent studies of Allied Signal metal oxide based absorbents demonstrated that these absorbents offer a unique capability to regeneratively remove both metabolic carbon dioxide and water vapor from breathing air; previously, metal oxides were considered only for the removal of CO<sub>2</sub>. The concurrent removal of CO<sub>2</sub> and H<sub>2</sub>O vapor can simplify the astronaut Portable Life Support System (PLSS) by combining the CO<sub>2</sub> and humidity control functions into one regenerative component. The use of metal oxide absorbents

for removal of both CO<sub>2</sub> and H<sub>2</sub>O vapor in the PLSS is the focus of an ongoing program. The full scale Metal Oxide Carbon dioxide and Humidity Remover (MOCHR) and regeneration unit is described.

ESA

### **N92-27022# Alenia Spazio S.p.A., Turin (Italy). NEW PERSPECTIVES OF LIVING IN SPACE: HABITABILITY GUIDELINES FOR FUTURE MANNED SPACE SYSTEMS**

MARIA STELLA LAVITOLA, CARLO TOMATIS, and ROBERTO PINOTTI (Futuro S.R.L., Florence, Italy ) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1115-1120 Dec. 1991  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

Key aspects to be considered when designing inhabited space vehicles and structures are discussed. These include: mission duration, number of crew, level of gravity, level of radiation, and distance from Earth. Information gathered from previous space missions and from terrestrial analogs which can be used for deriving architectural guidelines for future manned space systems is considered. The following are discussed: ergonomics, internal volume distribution, environment quality, acoustic isolation, food management, rest and recreation health maintenance, hygiene, sleeping, physical exercise. Two possible habitat configurations for a Moon base are presented; an inflatable spherical structure able to house a large community (12 to 13 people) and a module structure conceived for an initial limited community, with the capability to be extended further for up to 12 astronauts.

ESA

### **N92-27023# Nelson Space Services Ltd., London (England). CONCEPT FOR A EUROPEAN SPACE STATION: HABITABILITY, LIFE SUPPORT, AND LABORATORY FACILITIES**

R. C. HUTTENBACH, S. D. ORAM, D. A. NIXON, NICK LARTER, and M. COLASSON (Colasson, M., Paris, France ) /n ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1121-1135 Dec. 1991  
Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

A concept for a European space station is described and details of its habitability, life support, safety, power supply, control and laboratory facilities are outlined. There are many opportunities to improve the design of crew accommodation, environmental control, life support systems and laboratory facilities beyond those planned for Space Station Freedom. Using an advanced configuration of the Station, the following are described: approaches to the design of crew habitability facilities; the outfitting of equipment; environmental control and life support; crew safety and survivability; power supply; data and communications; and the design of laboratory facilities. Driving these proposals is the need to provide a stimulating and sustaining environment that will accommodate crew safety and in a manner that will optimize their efficiency and productivity during all stages of the Station's build up.

ESA

**N92-27025# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Columbus Crew Activities and On-Board Payload Operations.**

### **CREW-FRIENDLY SUPPORT SYSTEMS FOR INTERNAL VEHICULAR ACTIVITIES IN ZERO GRAVITY, EXPERIMENTED UNDERWATER FOR THE COLUMBUS PROGRAMME**

CARLO VIBERTI /n its 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1141-1146 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

With respect to the past manned enterprises, the new European challenge in space, the Columbus program, is characterized by a completely new operational scenario; this calls for comprehensive tests in representative zero gravity environments not only of external vehicular activities, but also of internal operations to verify design solutions and evaluate both operational aspects and crew procedures inside the Columbus modules, especially as far as

crew support systems such as mobility and stability aids are concerned. The first results attained in parabolic flights and underwater testing are highlighted. ESA

**N92-27026#** Alenia Spazio S.p.A., Turin (Italy).

**MOON BASE HABITABILITY ASPECTS**

MARIA ANTONIETTA PERINO *In* ESA, 4th European Symposium on Space Environmental Control Systems, Volume 2 p 1147-1154 Dec. 1991

Avail: NTIS HC/MF A23; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 150 Dutch guilders (2 vols)

The main habitat requirements for a Moon base are identified and analyzed. Various issues and technologies related to the local environment in which human beings will operate must be considered so as to choose from among different scenarios and to identify possible design solutions. Moreover, the mission characteristics play an important role in the basic sizing of the habitat, that depend heavily on the crew size and length of stay according to the different phases of the enterprise. Considerations about the influence of human aspects on the habitat design are also drawn, and the requirements to ensure maximum crew safety are outlined. The main habitat features are described, according to a multistep Moon base design approach. The Environment Control and Life Support System (ECLSS) is also regarded as an essential subsystem for any manned space system, and it will require a growing level of self sufficiency with the development of the Moon base's needs. A modular design of the ECLSS is proposed to adapt it for either variable capacities or different evolutionary stages. ESA

**N92-27179#** North Atlantic Treaty Organization, Brussels (Belgium).

**THE STUDY ON A DIRECTORY OF HUMAN PERFORMANCE MODELS FOR SYSTEM DESIGN (DEFENCE RESEARCH GROUP PANEL 8 ON THE DEFENCE APPLICATIONS OF HUMAN AND BIO-MEDICAL SCIENCES)**

1992 310 p

(AD-A247346; AC/243(PANEL 8)TR/1) Avail: NTIS HC/MF A14

This report catalogues over fifty human performance models and model development tools which are applicable to system design. It provides potential model users with brief reviews of each model, presented in a standard format. It is meant to be a practical source book, and does not address mathematical or theoretical issues to any great extent. Each chapter is aimed at a specific problem area in the system design/development cycle. Chapter topics include task allocation and workload prediction, single task models, multi-task models, multi-operator models, biomechanics and work space design, training and skill retention models, and network Modeling tools. Author (GRA)

**N92-27350#** Naval Postgraduate School, Monterey, CA.

**HUMAN-POWERED HELICOPTER: A PROGRAM FOR DESIGN AND CONSTRUCTION M.S. Thesis**

SCOTT A. BRUCE Jun. 1991 130 p

(AD-A246821) Avail: NTIS HC/MF A07

The various aspects of helicopter design and human powered aircraft design are studied to present a program to design and build a human powered helicopter (HPH) at the Naval Postgraduate School. The HPH will be designed to meet the requirements for the AHS-Sikorsky Award. The helicopter design is refined, and the feasibility of construction is assessed. In addition to pursuing a significant historical achievement, the program seeks to enhance the helicopter and composite programs of the Aeronautical Engineering curriculum at the NPS. Benefits to NPS in terms of research topics and as a research aircraft are presented. Potential future uses for ultralow powered aircraft technology are also outlined. GRA

**N92-27358#** McMaster Univ., Hamilton (Ontario). Dept. of Physical Education.

**EVALUATION OF ALTERNATIVE METHODS FOR INCREASING TOLERANCE TO +GZ ACCELERATION, PHASE 3 Final Report**

J. D. MACDOUGALL Jun. 1991 44 p  
(Contract DCIEM-W7711-9-7091-01-XSE)  
(CTN-92-60539) Avail: NTIS HC/MF A03

The effectiveness of anti-G counter maneuver depends upon the extent to which it elevates central arterial blood pressure so that cerebral flow can be maintained during radial headward acceleration (Gz). The effectiveness of various components of the anti-G straining maneuver was evaluated by directly recording arterial blood pressure at different Gz accelerations. The following results were obtained: (1) an indwelling pressure-tip transducer is preferable to an external fluid column-coupled transducer for measurement of blood pressure for human centrifuge experimentation; (2) assuming no reflex vasoconstriction, blood pressure declines directly according to vertical distance above the heart and to the level of the Gz acceleration; (3) an isometric leg contraction protocol which involves brief relaxation phases is no more effective than an uninterrupted isometric contraction over the same duration; (4) when subjects attempt to maintain a maximum contraction of the leg muscles for an extended period of time, the blood pressure response is unaffected by the decline in force due to fatigue; (5) the anti-G suit inflation protocol used in the study elevates mean blood pressure by approximately 11 Torr per Gz for gradual onset and 18 Torr per Gz for rapid onset; (6) the increase in blood pressure provided by the standard straining maneuver is caused by both the contraction of the muscles of the lower body and by an increased intrathoracic pressure through a respiratory straining maneuver; (7) during Gz acceleration, visual impairment tends to occur when eye-level mean blood pressure falls to approximately 47 Torr; and (8) a critical factor affecting G-induced loss of consciousness is the total accumulated time over which effective brain flow is suspended. CISTI

**N92-27372** Department of the Navy, Washington, DC.

**PIVOTING SEAT FOR FIGHTER AIRCRAFT Patent**

CHI TUNG, inventor (to Navy) 12 Nov. 1991 7 p Filed 26 Sep. 1990

(AD-D015244; US-PATENT-5,064,146;

US-PATENT-APPL-SN-589703; US-PATENT-CLASS-244-122)

Avail: US Patent and Trademark Office

A high-performance aircraft seat is disclosed that automatically reacts to recline the pilot as the aircraft experience higher G's in the vertical direction, or along the pilot's Z-axis. The seat, consisting of a seat pan joined to a seat back, is hingedly fixed, at a point forward of the pilot/seat combination center of gravity, to the surface. An hydraulic cylinder is fixed between the surface, aft of the hinge point and the seat back, and will react to return the seat to its initial position, from a G-force induced reclining position, whenever the G forces subside. GRA

**N92-27664#** Defence Research Establishment, Ottawa (Ontario).

**DEVELOPMENT OF A STANDARD ANTHROPOMETRIC DIMENSION SET FOR USE IN COMPUTER-AIDED GLOVE DESIGN**

DAVID HIDSON Oct. 1991 32 p

(AD-A246272; DREO-TN-9122) Avail: NTIS HC/MF A03

Anthropometric variables have always been measured with tapes and calipers and the data gathered have been the source material for designers and patternmakers in the development of NBCW protective equipment. This paper describes the re-assessment of the variables and dimensions under consideration and the construction of a new set of variables, for measuring hands, localized in three dimensional space, that may be measured by traditional techniques but yet be suited to CAD/CAM applications. A set of fifty dimensions was devised and a datum from which to measure was defined. Data were taken from a small sample of hands and a computerized model constructed. Models may be constructed from fewer dimensions but there will be less variability in the resultant surface. GRA

**N92-27990#** Walter Reed Army Inst. of Research, Washington, DC.

**CHARACTERIZATION OF PEAK INSPIRATORY FLOW AND ALVEOLAR VENTILATION DURING MAXIMAL ARM CRANK EXERCISE WITH AND WITHOUT INSPIRATORY AIRFLOW RESISTANCE Final Report, Mar. 1989 - Oct. 1991**

KENNETH G. TORRINGTON, CAREN K. EUSTER, and KENNETH T. DODD 21 Oct. 1991 47 p  
(Contract DA PROJ. 3M1-61102-BS-15)  
(AD-A247298; WRAIR-TR-91-001) Avail: NTIS HC/MF A03

The Army requires an accurate understanding of ventilatory requirements for combat vehicle crewmen. This study was conducted to measure 3 specific ventilatory parameters in exercising soldiers so that (1) Army engineers would be able to optimize design specifications for tank air delivery systems, (2) strategists would be better able to develop doctrine regarding use of the disconnected protective mask apparatus (Mission Oriented Protective Posture Gear), and (3) military planners would be better able to predict carbon monoxide hazards for tank crewmen. The objective of the current protocol was to measure maximal human ventilatory parameters during upper body exercise to extend the application of observations made during a previous field study of tank crewman's requirements. This study will provide measurements of peak inspiratory flow ( $V_{sub i}$  peak), estimates of alveolar ventilation ( $v_{sub A}$ ), and understanding of respiratory muscle fatigue. GRA

**N92-27991#** Army Aeromedical Research Lab., Fort Rucker, AL.

**SOUND ATTENUATION CHARACTERISTICS OF THE DH-133A HELMET Final Report**

BEN T. MOZO, BARBARA A. MURPHY, and LINDA S. BARLOW  
Jan. 1992 25 p  
(Contract DA PROJ. 3M1-62787-A-878)  
(AD-A248351; USAARL-92-8) Avail: NTIS HC/MF A03

This report documents the sound attenuation characteristics of a product improvement of the standard DH-132A helmet. Results indicate the improved helmet exceeds the attenuation required by the specification at all test frequencies and is significantly better than the DH-132 at most frequencies. A spring tension band between the earcups, improves earcup-to-head retention. A thermo-plastic liner improves stability and comfort. All of the improvements are available in kit form for field upgrade of fielded DH-132A helmets. GRA

**N92-28071#** Aerospace Medical Research Labs., Brooks AFB, TX.

**ERGONOMICS MANUAL Final Report**

JUDITH A. HOLL Oct. 1991 100 p  
(AD-A246934; AL-TR-1991-0082) Avail: NTIS HC/MF A05

This report is written to help base-level aerospace medicine services personnel establish a program for identifying and correcting ergonomic deficiencies in workplaces on their bases. It is provided as a starting point for assembling information and learning about ergonomics. A suggested bibliography is included that will help establish reference libraries. This report is not an all-inclusive reference, but highlights major areas of ergonomics. More detailed texts should be used for indepth information. GRA

**N92-28157\*#** National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.

**JOHNSON SPACE CENTER'S REGENERATIVE LIFE SUPPORT SYSTEMS TEST BED**

DONALD L. HENNINGER, TERRY O. TRI, DANIEL J. BARTA, and RANDAL S. STAHL 1991 11 p  
(NASA-TM-107943; NAS 1.15:107943) Avail: NTIS HC/MF A03

The Regenerative Life Support System (RLSS) Test Bed at NASA's Johnson Space Center is an atmospherically closed, controlled environment facility for the evaluation of regenerative life support systems using higher plants in conjunction with physicochemical life support systems. When completed, the facility will be comprised of two large scale plant growth chambers, each

with approximately 10 m(exp 2) growing area. One of the two chambers, the Variable Pressure Growth Chamber (VPGC), will be capable of operating at lower atmospheric pressures to evaluate a range of environments that may be used in Lunar or Martian habitats; the other chamber, the Ambient Pressure Growth Chamber (APGC) will operate at ambient atmospheric pressure. The root zone in each chamber will be configurable for hydroponic or solid state media systems. Research will focus on: (1) in situ resource utilization for CELSS systems, in which simulated lunar soils will be used in selected crop growth studies; (2) integration of biological and physicochemical air and water revitalization systems; (3) effect of atmospheric pressure on system performance; and (4) monitoring and control strategies. Author

**N92-28166#** Defence Research Establishment, Ottawa (Ontario).

**THERMAL RESISTANCE VALUES OF SOME PROTECTIVE CLOTHING ENSEMBLES**

BRAD CAIN Oct. 1991 15 p  
(AD-A245937; DREO-TN-91-24) Avail: NTIS HC/MF A03

This report describes methods used to predict the thermal insulation values of thin clothing ensembles and compares the results to those obtained from thermal manikin measurements. In calm conditions, the results compare favorably. In windy conditions, the predicted thermal resistance is greater than the measured value. This is because the theory used does not include wind induced ventilation of the clothing and the accompanying increase in heat transfer. GRA

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## SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

**A92-44651\*** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

**NUCLEOTIDES AS NUCLEOPHILES - REACTIONS OF NUCLEOTIDES WITH PHOSPHOIMIDAZOLIDE ACTIVATED GUANOSINE**

ANASTASSIA KANAVARIOTI, MORGAN T. ROSENBAACH, and T. B. HURLEY (California, University, La Cruz) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 199-217. refs  
(Contract NCA2-474)  
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On the basis of recently discovered RNAs with catalytic capabilities resembling those of enzymes, it is postulated that an 'RNA world' may have played a determining role in prebiotic chemistry and led evolution from prebiological to biological systems. The advent of the RNA world thus postulated, however, entails the preexistence of ribomononucleotides, and presumes that their reactions resulted in templatelike oligonucleotides. Attention is presently given to the reaction of nucleoside monophosphates with the phosphoimidazole-activated nucleosides that (1) have successfully been used in place of the natural nucleoside triphosphates and (2) for whose prebiotic existence there is now some evidence. O.C.

**A92-44652**

**CHEMICAL EVOLUTION OF THE CITRIC ACID CYCLE - SUNLIGHT PHOTOLYSIS OF THE AMINO ACIDS GLUTAMATE AND ASPARTATE**

THOMAS G. WADDELL and TOD J. MILLER (Tennessee, University, Chattanooga) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 219-223. Research supported by University of Tennessee and U.C. Foundation-Grote Chemistry Funds. refs  
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Sunlight photolysis of the amino acids glutamate and aspartate

were carried out on 0.1 M aqueous solutions at pH = 7.0. The nonvolatile products were identified by GC-MS analysis of derived methyl esters. The major product from glutamic acid was succinic acid, and, analogously, aspartic acid photolyzed to malonic acid. The photochemical oxidative decarboxylation of glutamate parallels its metabolism in modern cells and may provide an evolutionary link between simple amino acids and reactions of the citric acid cycle. Author

**A92-44653\*** National Aeronautics and Space Administration, Washington, DC.

**POSSIBLE PREBIOTIC SIGNIFICANCE OF POLYAMINES IN THE CONDENSATION, PROTECTION, ENCAPSULATION, AND BIOLOGICAL PROPERTIES OF DNA**

ISABEL BAEZA, MIGUEL IBANEZ, CARLOS WONG (Escuela Nacional de Ciencias Biologicas, Mexico City, Mexico), PEDRO CHAVEZ, PATRICIO GARIGLIO (Instituto Politecnico Nacional, Mexico City, Mexico), and J. ORO (Houston, University, TX) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 225-242. Research supported by Instituto Politecnico Nacional and CONACYT. refs (Contract NGR-44-005-002)

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While DNA which has undergone ionic condensation with  $\text{Co(3+)(NH}_3\text{)}_6$  is resistant to the action of the endonuclease DNase I, in much the same way as DNA condensed with spermidine, it was significantly less active in transcription with the *E. coli* RNA polymerase than DNA-spermidine condensed forms. Although both compacted forms of DNA were more efficiently encapsulated into neutral liposomes, negatively charged liposomes were seldom formed in the presence of the present, positive ion-condensed DNA; spermidine is accordingly proposed as a plausible prebiotic DNA-condensing agent. Attention is given to the relevance of the polyimide-nucleic acids complexes in the evolution of life. O.C.

**A92-44654**

**CONTRIBUTION OF TEMPERATURE GRADIENT TO AGGREGATION OF THERMAL HETEROCOPOLYMERS OF AMINO ACIDS IN AQUEOUS MILIEU**

EIICHI IMAI, JUN SHIRASAWA, HAJIME HONDA, and KOICHIRO MATSUNO (Nagaoka University of Technology, Japan) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 243-249. refs

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The suspension obtained by solubilizing the thermal heterocopolymers of amino acids, aspartic acid, and proline in boiling distilled water was cooled at a controlled rate. The maximum growth of phase-separated microspheres was determined to occur at a finite, nonzero cooling rate; this temperature gradient-controlled growth indicates that the aggregation of thermal heterocopolymers of amino acids in their aqueous milieu is irreversible. Attention is drawn to the significance of such irreversibility to evolutionary theory. O.C.

**A92-44656**

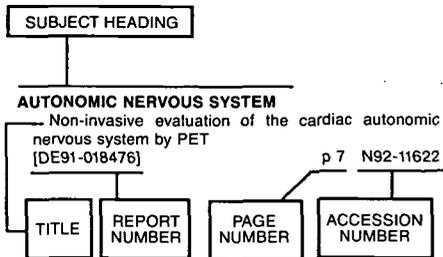
**THE VIKING BIOLOGY EXPERIMENTS - EPILOGUE AND PROLOGUE**

HAROLD P. KLEIN (Santa Clara University, CA) (International Symposium on the Biological Exploration of Mars, Tallahassee, FL, Oct. 26, 27, 1990) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 21, no. 4, 1991-1992, p. 255-261. refs

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The present retrospective evaluation of the Viking spacecraft-based explorations for life on Mars gives attention to the experimental artefacts that arose during the mission, with a view to the extent that they represented gaps in the contemporary understanding of the Martian environment. Many of these issues are noted to remain unresolved; future efforts to explore for analogues of earthly biology should accordingly be postponed until more adequate information about habitable microenvironments has become available. O.C.

## Typical Subject Index Listing



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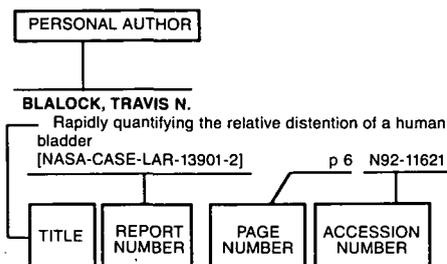
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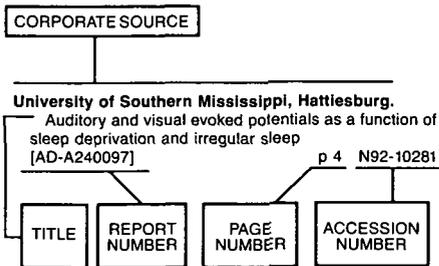
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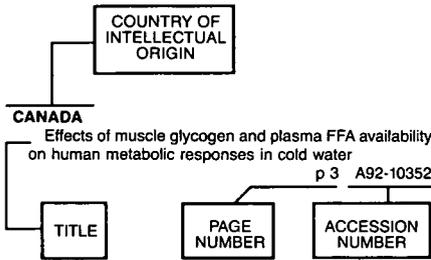
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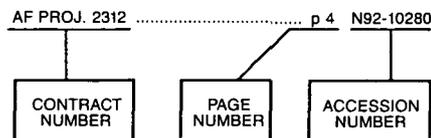
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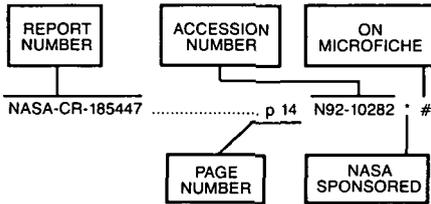
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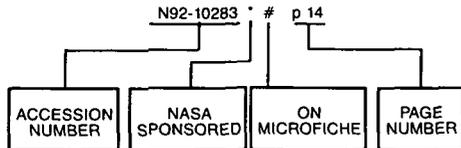


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