



Aerospace Medicine  
and Biology  
A Continuing  
Bibliography  
with Indexes

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
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## ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

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# **AEROSPACE MEDICINE AND BIOLOGY**

**A CONTINUING BIBLIOGRAPHY  
WITH INDEXES**

**(Supplement 314)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in August 1988 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Division 1988  
National Aeronautics and Space Administration  
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# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 139 reports, articles and other documents announced during August 1988 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

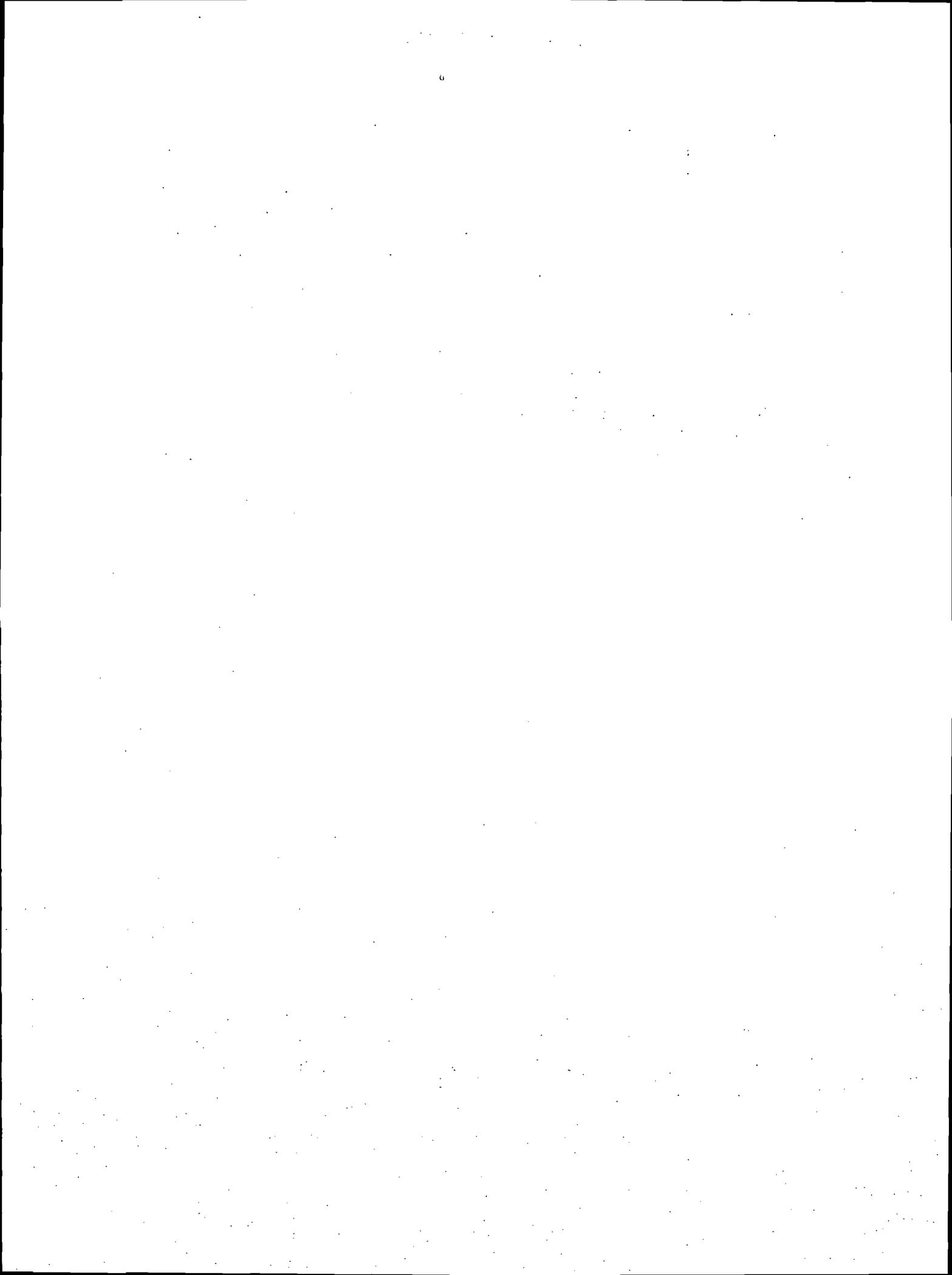
In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of 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. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a 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, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

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

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1988 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.



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## TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED

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ON MICROFICHE

ACCESSION NUMBER → **N88-10483\*** # Texas Univ., Houston. Health Science Center. ← CORPORATE SOURCE

TITLE → **PREVENTION OF DISUSE OSTEOPOROSIS: EFFECT OF SODIUM FLUORIDE DURING FIVE WEEKS OF BED REST Final Report** ← PUBLICATION DATE

AUTHOR → **VICTOR S. SCHNEIDER** Oct. 1987 64 p ← AVAILABILITY SOURCE

REPORT NUMBERS → (Contract NAS9-16688) (NASA-CR-172018; NAS 1.26:172018) Avail: NTIS HC A04/MF ← PRICE CODE

COSATI CODE → **A01 CSCL 06E**

An attempt was made to modify factors which promote disuse osteoporosis and thereby prevent it from occurring. Since fluoride is currently used to enhance bone formation in the treatment of low turnover osteoporosis, it was hypothesized that if the fluoride ion was available over a long period of time that it would slow the demonstrated loss of calcium by inhibiting bone resorption and enhancing bone formation. This study was used to determine whether oral medication with sodium F will modify or prevent 5 weeks of bed rest induced disuse osteoporosis, to determine the longitudinal effects of 5 weeks of bed rest on PTH, CT and calcitriol, to measure muscle volume changes and metabolic activity by magnetic resonance imaging and magnetic resonance spectroscopy during prolonged bed rest, to measure changes in peak muscle strength and fatigability, and to measure bone turnover in bone biopsies. Subjects were studied during 1 week of equilibration, 4 weeks of control ambulation, 5 weeks of bed rest, and 1 week of reambulation. E.R.

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

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ACCESSION NUMBER → **A88-12321\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TITLE → **CONTINUOUS MONITORING OF BLOOD VOLUME CHANGES IN HUMANS**

AUTHORS → **H. HINGHOFER-SZALKAY and J. E. GREENLEAF** (NASA, Ames Research Center, Moffett Field, CA; Graz, Universitaet, Austria) ← AUTHOR'S AFFILIATION

JOURNAL TITLE → **Journal of Applied Physiology** (ISSN 0161-7567), vol. 63, Sept. 1987, p. 1003-1007. Research supported by the Oesterreichische Akademie der Wissenschaften. refs ← PUBLICATION DATE

(Contract NASA TASK 199-21-12-07)

Use of on-line high-precision mass densitometry for the continuous monitoring of blood volume changes in humans was demonstrated by recording short-term blood volume alterations produced by changes in body position. The mass density of antecubital venous blood was measured continuously for 80 min per session with 0.1 g/l precision at a flow rate of 1.5 ml/min. Additional discrete plasma density and hematocrit measurements gave linear relations between all possible combinations of blood density, plasma density, and hematocrit. Transient filtration phenomena were revealed that are not amenable to discontinuous measurements. I.S.

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 314)*

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## LIFE SCIENCES (GENERAL)

**A88-37291#**

### **BOTANY FACILITY - AN ARTIFICIAL ENVIRONMENT FOR PLANTS IN SPACE**

PETER KERN and WOLFRAM LORK Dornier-Post (English Edition) (ISSN 0012-5563), no. 1, 1988, p. 36, 37.

Due to the short duration of past botanical experiments in microgravity conditions, the long-term effect of space mission duration on plants remains unclear. The ESA Eureca platform will accordingly address this question and the related one as to whether plants grown under microgravity for several generations maintain their CO<sub>2</sub>-to-O<sub>2</sub> metabolic conversion rate, as required for the biological control of life support systems. Eureca is scheduled for Space Shuttle launch in 1990 for a six-month mission. Attention is given to the design features of the 30 cuvettes forming the life environments for the plants. O.C.

**A88-37447**

### **CONTROL OF LEFT VENTRICULAR FUNCTION DURING ACCELERATION-INDUCED BLOOD VOLUME SHIFTS**

GREGORY N. WHITE, CHARLES F. KNAPP, JOYCE M. EVANS, and DAVID C. RANDALL (Kentucky, University, Lexington) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 433-439. refs  
(Contract NIH-HL-19343; F49620-79-C-0014)

The response of the heart to acceleration-induced blood volume shifts was assessed in dogs subjected to a +2 Gz force for 3 min, followed by a quick return to normal Gz (thus causing a blood shift toward the thoracic cavity). The values of the left ventricular volume, calculated from ultrasound measurements of major and minor axes and wall thickness, increased from about 21.7 ml diastolic and 14.1 ml systolic during the peripheral pooling of blood, to about 28.2 ml diastolic and 16.0 ml systolic measured two minutes after the release of the +Gz force. The maximum first time derivative of left ventricular pressure was not changed. The experiment was repeated after total pharmacologic autonomic blockade (propranolol, atropine, phenoxybenzamine), with results essentially similar to those of the first experiment, suggesting that the heart does not involve the autonomic nervous system in the adaptation to the G-load changes, but relies mainly upon the Frank-Starling mechanism. I.S.

**A88-37706**

**BIOMEDICAL AND SOCIAL/PSYCHOLOGICAL PROBLEMS CONNECTED WITH SPACE FLIGHT AND THE INVESTIGATION OF EXTREME ENVIRONMENTS ON EARTH: A BIBLIOGRAPHY OF SOVIET AND NON-SOVIET LITERATURE FOR 1971-1975 [MEDIKO-BIOLOGICHESKIE I SOTSIAL'NO-PSIKHOLOGICHESKIE PROBLEMY OSVOENIYA KOSMOSA I REGIONOV ZEMLI S EKSTREMAL'NYMI USLOVIAMI SUSHCHESTVOVANIYA: UKAZATEL' OTECHESTVENNOI I ZARUBEZHNOI LITERATURY 1971-1975]**

N. N. MIKHAILOVA, E. A. AKHUTIN, S. P. FINOGENOVA, V. P. ALEKSEEVA, and M. L. SHVARTS Moscow, Izdatel'stvo Nauka, 1987, 602 p. In Russian.

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

**A88-37785**

### **SEGREGATION OF FORM, COLOR, MOVEMENT, AND DEPTH - ANATOMY, PHYSIOLOGY, AND PERCEPTION**

MARGARET LIVINGSTONE and DAVID HUBEL (Harvard University, Boston, MA) Science (ISSN 0036-8075), vol. 240, May 6, 1988, p. 740-749. refs

Physiological and anatomical studies of the primate visual system show it to consist of independent subdivisions which analyze different areas of the same retinal image. Cells in the two cortical visual areas, as well as higher visual areas, are segregated into three dovetailed subdivisions differing in their selectivity for color, stereopsis, movement, and orientation. At lower levels, cells in the two subdivisions differ in color selectivity, contrast sensitivity, temporal properties, and spatial resolution, leading to the prediction that such different visual functions as color, depth, movement, and form perception, should exhibit corresponding differences. It is noted that human perceptual experiments are consistent with these predictions. O.C.

**A88-37787**

### **DIRECT OBSERVATION OF THE FEMTOSECOND EXCITED-STATE CIS-TRANS ISOMERIZATION IN BACTERIORHODOPSIN**

RICHARD A. MATHIES, WALTER T. POLLARD (California, University, Berkeley), C. H. BRITO CRUZ, and CHARLES V. SHANK (AT&T Bell Laboratories, Holmdel, NJ) Science (ISSN 0036-8075), vol. 240, May 6, 1988, p. 777-779. refs  
(Contract NIH-GM-27057; NSF CHE-86-15093)

Femtosecond optical measurement techniques have been used to study the primary photoprocesses in the light-driven transmembrane proton pump bacteriorhodopsin. Light-adapted bacteriorhodopsin was excited with a 60-femtosecond pump pulse at 618 nanometers, and the transient absorption spectra from 560 to 710 nanometers, were recorded from -50 to 1000 femtoseconds by means of 6-femtosecond probe pulses. By 60 femtoseconds, a broad transient hole appeared in the absorption spectrum whose amplitude remained constant for about 200 femtoseconds. Stimulated emission in the 660- to 710-nanometer region and excited-state absorption in the 560- to 580-nanometer region appeared promptly and then shifted and decayed from 0 to about 150 femtoseconds. These spectral features provide a direct observation of the 13-trans to 13-cis torsional isomerization of the retinal chromophore on the excited-state potential surface. Absorption due to the primary ground-state photoproduct J appears with a time constant of about 500 femtoseconds. Author

A88-39489

**BOTANICAL PAYLOADS FOR PLATFORMS AND SPACE STATIONS [BOTANISCHE NUTZLASTEN FUER PLATTFORMEN UND RAUMSTATIONEN]**

H. R. LOESER (MBB-ERNO Raumfahrttechnik GmbH, Bremen, Federal Republic of Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung (ISSN 0342-068X), vol. 12, Mar.-Apr. 1988, p. 116-121. In German.

The scientific aims and technological implementation of botany experiment packages for Eureka and the Columbus platforms of the International Space Station are reviewed. Both basic research in seed germination and plant development, tropisms, circunutation, and chronobiology under space conditions and practical studies of the role of growing plants in long-term space missions are considered. The Botany Facility for Eureka is described in detail and illustrated with drawings, diagrams, flow charts, and photographs, and the initial design concept for the Columbus Gravitational Biology Facility is briefly discussed. Particular attention is given to technological challenges regarding centrifuge design, the minimization of the air and water consumption of the life-support system, and the recycling of water and CO<sub>2</sub> extracted from the crew air supply. T.K.

A88-39527

**THE EFFECTS OF DIFFERENT TYPES OF HYPOXIA ON OXYGEN IN THE MUSCLE TISSUE, AND THE MECHANISMS OF ITS REGULATION [VLIANIE GIPOKSII RAZLICHNOGO PROISKHOZHDENIIA NA KISLORODNYI REZHIM MYSHECHNOI TKANI I MEKHANIZMY EGO REGULIATSII]**

I. N. MAN'KOVSKAIA and M. M. FILIPPOV (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Mar.-Apr. 1988, p. 56-63. In Russian. refs

The effects of different types of hypoxia upon the characteristics of the oxygen exchange and the mechanisms of its regulation in rat muscle were investigated by measuring the parameters of oxygen exchange and regulation in rats affected with three types of hypoxia: hypoxic hypoxia induced by keeping rats at 2100 m above sea level; hemic hypoxia induced by systematic injections of sodium nitrite; and hypoxia induced by strenuous physical exercise (1-h-long daily swimming sessions for 4 months). The results show that the parameters of oxygen exchange were altered by different types of hypoxia differently. In rats exposed to hypoxic hypoxia, muscle hypoxia was compensated mainly by means of increased oxygen blood capacity, while in rats under systematic physical training, hypoxia was compensated by the improved oxygen diffusion in musculature due to an increased capillary network. Chronic hemic hypoxia led to the development of mixed forms of tissue hypoxia. I.S.

A88-39528

**EFFECTS OF INTENSE SHORT-TERM HEAT EXPOSURES AND ADRENALINE INJECTIONS ON THE RESISTANCE OF WHITE RATS TO HEAT [VLIANIE INTENSIVNYKH KRATKOVREMENNYKH VOZDEISTVII TEPLA I IN'EKTSII ADRENALINA NA TEPLOVUII USTOICHIVOST' BELYKH KRYSI]**

V. I. SOBOLEV and V. A. ANOKHIN (Donetskii Gosudarstvennyi Universitet, Donetsk, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Mar.-Apr. 1988, p. 63-67. In Russian. refs

A88-39529

**SOME COMPENSATION REACTIONS OF THE BLOOD SYSTEM TO PHENYLHYDRAZINE-INDUCED ANEMIA UNDER THE CONDITIONS OF MOUNTAINS OF MEDIUM HEIGHT AND PLAINS [O NEKOTORYKH KOMPENSATORNYKH REAKTSIIAKH SISTEMY KROVI PRI FENILGIDRAZINOVOI ANEMII V USLOVIAKH RAVNINY I SREDNEGOR'IA]**

V. P. DUDAREV (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, Mar.-Apr. 1988, p. 67-74. In Russian. refs

The compensatory reactions to hemic hypoxia induced in rats

by systematic injections of phenylhydrazine were studied in rats kept at sea level or at an altitude of 2100 m. Thrice-weekly injections of 2-percent phenylhydrazine solutions for 1 month were found to decrease the number of erythrocytes, hemoglobin content, oxygen blood capacity, and 2,3 DPG concentration, and to increase the contents of methemoglobin and sulfhemoglobin. The oxygen-transport functions of the blood were restored on the 10th day after the cancellation of injections, due to an increase of hemoglobin content and, to a smaller extent, an increase of erythrocyte number. Adaptation to the altitude of 2100 m had no significant effect on the effects of hemic hypoxia. I.S.

A88-39873

**PREPARATION OF LANGMUIR FILMS OF PHOTOSYNTHETIC REACTION CENTERS OF PURPLE BACTERIA [POLUCHENIE LENGMIURONVSKIKH PLENOK FOTOSINTETICHESKIKH REAKTSIONNYKH TSENTROV PURPURNYKH BAKTERII]**

V. V. EROKHIN, R. L. KAIUSHINA, IU. M. L'VOV, N. I. ZAKHAROVA, A. A. KONONENKO (AN SSSR, Institut Kristallografii; Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 299, no. 5, 1988, p. 1262-1266. In Russian. refs

A88-39874

**EFFECT OF BLUE LIGHT ON ELECTRON TRANSPORT IN THE RESPIRATORY CHAIN OF MITOCHONDRIA [DEISTVIE SINEGO SVETA NA ELEKTRONNYI TRANSPORT V DYKHATEL'NOI TSEPI MITOKHONDRII]**

K. IA. KONDRAT'EV, V. A. KANEVSKII, I. V. KUZ'MENKO, A. F. LIDENKO, O. M. ROZHMANOVA (AN SSSR, Institut Ozerovedeniia, Leningrad, USSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 299, no. 5, 1988, p. 1271-1274. In Russian. refs

A88-39925#

**LEARNING A LANDMARK VISUAL DISCRIMINATION TASK IN CATS WITH LESIONS OF THE MIDDLE SUPRASYLVIAN GYRUS [OBUCHENIE ZRITEL'NOI DISKRIMINATSII ORIENTIRA U KOSHEK S PORAZHENIAMI SREDNEI SUPRASIL'VIOVI IZVILINII]**

N. V. VASHAKIDZE (Tbilisskii Gosudarstvennyi Universitet, Tbilisi, Georgian SSR) Akademiia Nauk Gruzinskoi SSR, Soobshcheniia (ISSN 0132-1447), vol. 129, Jan. 1988, p. 153-156. In Russian. refs

The learning of a landmark visual discrimination task and its two successive reversals were investigated in normal cats and in cats with bilateral lesions of the middle suprasylvian gyrus. It is shown that, compared with normal cats, the ones with lesions have significant deficits in learning and the two reversals. This points to the possible role of the middle suprasylvian gyrus in the allocentric spatial localization of food. B.J.

A88-39999

**EFFECT OF N<sub>2</sub>-HE-O<sub>2</sub> ON DECOMPRESSION OUTCOME IN RATS AFTER VARIABLE TIME-AT-DEPTH DIVES**

R. S. LILLO (U.S. Navy, Naval Medical Research Institute, Bethesda, MD) Journal of Applied Physiology (ISSN 0161-7567), vol. 64, May 1988, p. 2042-2052. Navy-supported research. refs

The effects of both the variable gas mixtures and variable time-at-depth on the outcome of decompression in rats were investigated. Unanesthetized rats were subjected to one of the two series of simulated dives: (1) 20-percent N<sub>2</sub>-He-O<sub>2</sub> dives at 175 feet of seawater (fsw) and (2) N<sub>2</sub>-O<sub>2</sub> dives with variable percentage of O<sub>2</sub> at depths from 141 to 207 fsw. Time at depth ranged from 10 to 120 min, after which rats were decompressed within 10 s to surface pressure. The probability of decompression sickness (severe bends symptoms or death) was analyzed with a single Hill equation dose-response model. It was found that, for bends, relative potencies for the three gases were of similar magnitude, whereas for death, the potencies were significantly different in the ascending order O<sub>2</sub>-He-N<sub>2</sub>. Estimated gas uptake rates were different: N<sub>2</sub> took three to four times as long as He to

reach full effect, whereas the rate of O<sub>2</sub> was considerably lower than that of either N<sub>2</sub> or He. I.S.

**A88-40000**  
**NOCTURNAL SHIFTS IN THERMAL AND METABOLIC RESPONSES OF THE IMMATURE RAT**

DONALD E. SPIERS (John B. Pierce Foundation Laboratory; Yale University, New Haven, CT) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, May 1988, p. 2119-2124. refs (Contract NIH-HD-18002)

The shifts of the thermoregulatory responses of rats to thermal stress during daily light cycle were investigated by carrying out continuous measurements of colonic (T<sub>co</sub>) and tail skin temperatures of young animals (2, 7, 11, and 15 days of age). Rats were tested individually in temperature-controlled cylinders at ambient temperatures of 25, 30, 32.5, and 35 C. The vivarium was illuminated from 0700 to 1900 h. Measurements of O<sub>2</sub> content in effluent air provided an estimate of metabolic rate (M). It was found that rats of 2 to 11 days of age, but not the 15-d-old rats, exhibited significant light:dark (L:D) differences in M and T<sub>co</sub> (i.e., rises during the nocturnal phase), and that the differences in T<sub>co</sub> response were not attributed to a significant change in total thermal conductance, indicating that the immature rat exhibits daily variation in metabolic rate, which is the primary contributor to L:D shifts in T<sub>co</sub>. I.S.

**A88-40682**  
**CRYSTAL STRUCTURE OF AN ANTIFREEZE POLYPEPTIDE AND ITS MECHANISTIC IMPLICATIONS**

D. S. C. YANG, M. SAX (USVA, Medical Center; Pittsburgh, University, PA), A. CHAKRABARTY, and C. L. HEW (Hospital for Sick Children; Toronto, University, Canada) *Nature* (ISSN 0028-0836), vol. 333, May 19, 1988, p. 232-237. Research supported by the University of Pittsburgh, Medical Research Council of Canada, and NIH. refs

The X-ray crystallographic structure of an antifreeze polypeptide from the fish winter flounder, has been determined at 2.5 Å by an analysis of the Patterson function. This is the first report of a polypeptide of this size that is a single alpha-helix. A proposed mechanism of antifreeze binding to ice surfaces is given which requires: first, that the dipole moment from the helical structure dictates the preferential alignment of the peptide to the c-axis of ice nuclei; second, amphiphilicity of the helix; and third, torsional freedom of the side chains to facilitate hydrogen bonding to ice surfaces. Author

**A88-40772** Salk Institute for Biological Studies, San Diego, Calif.

**EVOLUTION OF THE GENETIC APPARATUS - A REVIEW**

L. E. ORGEL (Salk Institute for Biological Studies, San Diego, CA) IN: Cold Spring Harbor Symposia on Quantitative Biology. Volume 52. Cold Spring Harbor, NY, Cold Spring Harbor Laboratory, 1987, p. 9-16. NIH-NASA-supported research. refs

The information available on the early period of evolution, i.e., the period preceding the fixation of the nucleic acid/protein system in its contemporary form, is discussed. Attention is given to the evolution of a genetic system based on nucleic acids and proteins from a prebiotic soup and to the evolution of a mechanism of molecular memory. Particular consideration is given to the enzymeless template-directed RNA-induced reactions and reactions catalyzed by ribozymes, and to hypothetical RNA predecessors. Various hypotheses concerning the evolution of the protein synthesis mechanism are discussed. I.S.

**A88-40787**  
**DIEL VERTICAL MOVEMENTS OF THE CYANOBACTERIUM OSCILLATORIA TEREBRIFORMIS IN A SULFIDE-RICH HOT SPRING MICROBIAL MAT**

Laurie L. Richardson and Richard W. Castenholz (Oregon, University, Eugene) *Applied and Environmental Microbiology* (ISSN 0099-2240), vol. 53, Sept. 1987, p. 2142-2150. NSF-supported research. refs

The vertical migration pattern exhibited by *Oscillatoria*

*terebriformis*, which forms large populations in Hunter's Hot Springs, Oregon, and the microenvironment in which the vertical movements occur were studied using photography, pH measurements, and chemical analyses. During the daylight hours, the *O. terebriformis* population covered the surface of microbial mat community, whereas upon darkness, the upper-surface population of this bacterium moved, by gliding motility, downward 0.5 to 1.0 mm into the microbial mat, remaining there until dawn and then rapidly returning to the top of the mats. The results of field studies showed that, as a result of this movement pattern, *O. terebriformis* regularly alternates between an aerobic light environment and an anaerobic dark reducing environment. Laboratory studies revealed a negative response of *O. terebriformis* to sulfide at concentrations similar to those found in the natural mats. The movement back to the surface at dawn is considered to be due to a combination of phototaxis, photokinesis, and the onset of oxygenic photosynthesis which consumes sulfide. I.S.

**A88-40788**  
**ENHANCED SURVIVAL OF THE CYANOBACTERIUM OSCILLATORIA TEREBRIFORMIS IN DARKNESS UNDER ANAEROBIC CONDITIONS**

Laurie L. Richardson and Richard W. Castenholz (Oregon, University, Eugene) *Applied and Environmental Microbiology* (ISSN 0099-2240), vol. 53, Sept. 1987, p. 2151-2158. refs

*Oscillatoria terebriformis*, a thermophilic cyanobacterium, maintained viability in darkness under anaerobic conditions by fermenting exogenous glucose or fructose to lactic acid. The time period of survival was greatly extended when the environmental redox potential was lowered by the addition of sodium thioglycolate or titanium (III) citrate. When exposed to aerobic conditions in darkness, many trichomes underwent lysis in 6 h, and death of all cells occurred in 2 to 3 days. The endogenous aerobic respiration rate was high, and the limited dark aerobic survival period appeared to be due to depletion of stored glycogen. Fructose or glucose did not support or increase aerobic respiration in darkness or lengthen aerobic survival time. Enhanced survival of *O. terebriformis* in darkness under anaerobic, reducing conditions correlates well with the natural nighttime position of this species within sulfide-rich microbial mats associated with hot springs of western North America. Author

**A88-40853**  
**EFFECT OF HYPERGRAVITY ON THE EMBRYOGENESIS AND SURVIVAL OF AMPHIBIANS [VLIANIE POVYSHENNOI SILY TIAZHISTI NA EMBRIONAL'NOE RAZVITIE I VYZHIVAEMOST' AMFIBII]**

E. A. Oigenblik (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) and G. P. Parfenov (Akademii Nauk SSSR, Izvestiia, Serii Biologicheskaiia (ISSN 0002-3329), May-June 1988, p. 346-351. In Russian. refs

The effect of hypergravity in the range of 2-30 g on the development of fertilized eggs of *Rana temporaria* was investigated. The sensitivity of embryos to centrifugal acceleration was found to depend on the magnitude and the duration of the centrifugal force and the stage of the embryo development. The most sensitive stages were the beginning of cleavage into eight blastomeres and the gastrula-neurula stage. At the stage gray crescent-eight blastomeres, the doses of 25 to 30 g resulted in over 90 percent lethality. I.S.

**A88-40854**  
**ROLE OF GLIA IN THE REACTION OF SNAIL NEURONS TO CONSTANT MAGNETIC FIELDS [ROL' GLII V REAKTSII NEIRONOV ULITKI NA POSTOIANNOE MAGNITNOE POLE]**

N. I. Bravarenko, P. M. Balaban, V. N. Mats, and A. N. Kuznetsov (AN SSSR, Institut Khimicheskoi Fiziki and Institut Vyshehei Nervnoi Deiatel'nosti i Neurofiziologii, Moscow, USSR) *Akademii Nauk SSSR, Izvestiia, Serii Biologicheskaiia* (ISSN 0002-3329), May-June 1988, p. 384-391. In Russian. refs

## 51 LIFE SCIENCES (GENERAL)

**A88-40855**

**PARTICIPATION OF PARAVENTRICULAR HYPOTHALAMIC NUCLEI IN THE DEVELOPMENT OF ADAPTATION TO COLD IN WHITE RATS [OB UCHASTII PARAVENTRIKULIARNYKH IADER GIPOTALAMUSA V RAZVITII KHOLODOVOI ADAPTATSII U BELYKH KRYS]**

N. K. KORMILITSYNA and I. I. BAZHENOV (Ivanovskii Gosudarstvennyi Universitet, Ivanovo, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 74, March 1988, p. 414-419. In Russian. refs

**A88-40856**

**THE CHARACTER OF CONJUGATE FUNCTIONS OF THE SKELETAL MUSCLE AND INTESTINE VESSELS DURING SEPARATE AND COMBINED EFFECTS ON THE ORGANISM OF HYPOXIA AND HYPOTHERMIA [KHARAKTERISTIKA SOPRIAZHENNYKH FUNKTSII SOSUDOV SKELETNOI MYSHTSY I KISHECHNIKA PRI RAZDEL'NOM I SOCHETANNOM DEISTVII GIPOKSII I GIPOTERMII NA ORGANIZM]**

A. A. NURMATOV, I. A. KUDRIASHOV, and B. I. TKACHENKO (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 74, April 1988, p. 517-524. In Russian. refs

**A88-40948\*** Wisconsin Univ., Milwaukee.

**BACTERIAL MANGANESE REDUCTION AND GROWTH WITH MANGANESE OXIDE AS THE SOLE ELECTRON ACCEPTOR**

CHARLES R. MYERS and KENNETH H. NEALSON (Wisconsin University, Milwaukee) Science (ISSN 0036-8075), vol. 240, June 3, 1988, p. 1319-1321. refs

(Contract NAGW-1047; NSF OCE-86-0978)

Microbes that couple growth to the reduction of manganese could play an important role in the biogeochemistry of certain anaerobic environments. Such a bacterium, *Alteromonas putrefaciens* MR-1, couples its growth to the reduction of manganese oxides only under anaerobic conditions. The characteristics of this reduction are consistent with a biological, and not an indirect chemical, reduction of manganese, which suggest that this bacterium uses manganic oxide as a terminal electron acceptor. It can also utilize a large number of other compounds as terminal electron acceptors; this versatility could provide a distinct advantage in environments where electron-acceptor concentrations may vary. Author

**A88-40991**

**EFFECTS OF ATROPINE AND PYRIDOSTIGMINE IN HEAT-STRESSED PATAS MONKEYS**

ELENI AVLONITOU and REYNALDO ELIZONDO (Indiana University, Bloomington) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 544-548. refs

(Contract F33615-83-D-0603)

The effects of atropine and pyridostigmine treatments on the thermoregulatory effector responses of patas monkeys exposed to 35 C were compared to responses measured at 25 C. The effects of a single i.m. atropine injection at 25 and 35 C were found to be qualitatively similar, but the response was greater at 35 C. At 35 C, a single injection of atropine led to decreases in sweating (Esw) by 52 percent, increased rectal temperature (Tre), mean skin temperature (Tsk), metabolic rate (MR), and whole body conductance and to an increase in heart rate (HR). Daily oral pyridostigmine treatment (0.4 mg/kg, 3 times/d over a period of 7 d) of heat-stressed monkeys caused a 25-30 drop in serum cholinesterase activity with no chronic effects on thermoregulatory or cardiovascular functions. The acute effects of oral treatment included transient decreases in MR (by 12 percent) and HR (by 15 percent) and a transient increase in Esw (by 25 percent); the latter was associated with acute reductions in Tre and Tsk. I.S.

**A88-41076**

**PARTICIPATION OF NEUROMEDIATORS IN THE HYPOTHALAMIC MECHANISMS FOR PROCESSING TEMPERATURE INFORMATION [OB UCHASTII NEIROMEDIATOROV V GIPOTALAMICHESKIKH MEKHANIZMAKH OBRABOTKI TEMPERATURNOI INFORMATSII]**

V. N. GURIN and E. M. BELIAVSKII (AN BSSR, Institut Fiziologii, Minsk, Belorussian SSR) Akademiia Nauk BSSR, Doklady (ISSN 0002-354X), vol. 32, no. 5, 1988, p. 471-474. In Russian. refs

Neurochemical mechanisms responsible for the temperature regulation of an organism are discussed on the basis of recent data obtained on the activity of various neuromediators upon the heat-sensitive and cold-sensitive hypothalamic neurons. Special attention is given to the role of prostaglandins in the development of high fever and to the effects of bacterial pyrogens on this process. It is hypothesized that pyrogens might alter the structure of the brain-blood barrier. Thus, acyclidine and metacin, which normally penetrate the brain-blood barrier very poorly, significantly increase their respective central effects in subjects infected with bacteria producing high fever. I.S.

**N88-22512#** Pennsylvania Univ., Philadelphia: Dept. of Bioengineering.

**MICROWAVE DISPERSION AND ABSORPTION IN TISSUES: MOLECULAR MECHANISMS Final Report, 1 Jan. 1978 - 28 Feb. 1986**

KENNETH R. FOSTER 10 Dec. 1987 13 p

(Contract N00014-78-C-0392; PROJ. RR0-4108)

(AD-A190118) Avail: NTIS HC A03/MF A01 CSDL 06G

We measured the dielectric properties of materials (tissues, aqueous protein solutions, microemulsions, macroscopic suspensions) from 0.1 to 18 GHz. These properties are determined over this frequency range by the dielectric properties of water and by ionic effects. Analysis of the data shows that the dielectric properties of the suspending water differ from those of the pure liquid, presumably due to interfacial effects. Similar effects are seen in diverse transport properties and even in nonaqueous systems. The results suggest that water within a couple of monolayers from surfaces have motional correlation times that are tenfold or so longer than those of the bulk liquid. We suggest that this motional restriction is a physical effect due to the presence of relatively immobile surfaces, rather than from chemically specific binding. This study has led to an improved understanding of the mechanisms of absorption of microwave energy in tissues, and shown the usefulness of comparative studies of transport processes in complex suspensions. GRA

**N88-22513#** Pacific Northwest Labs., Richland, Wash.

**CHARACTERIZATION OF SPACE RADIATION ENVIRONMENT IN TERMS OF THE ENERGY DEPOSITION IN FUNCTIONALLY IMPORTANT VOLUMES**

L. A. BRABY, N. F. METTING, W. E. WILSON, and C. A. RATCLIFFE Jan. 1988 10 p Presented at the Conference on High Energy Radiation Background in Space, Sanibel Island, Fla., 3 Nov. 1987

(Contract DE-AC06-76RL-01830)

(DE88-005627; PNL-SA-15056; CONF-8711149-1) Avail: NTIS HC A02/MF A01

Since the damage which initiates detrimental effects occurs in a small site (semiconductor junctions, or biological cell nuclei), these differences in spatial distribution of ionization maybe the relevant factor controlling the effectiveness of different radiations. Again, when the appropriate cross section data are available Monte Carlo methods can be used to simulate the positions of all ionizations and excitations produced by a typical charged particle. This calculated track structure must interact with the biological or electronic entity in which it occurs to produce the effect. However, we do not know the mechanisms of this interaction and thus cannot specify which characteristics of the charged particle track are responsible for the relevant damage. From track structure we can obtain the spectrum of energy deposition in small volumes which may be relevant to the processes of concern. This has led

to a new approach to dosimetry, one which emphasizes the stochastic nature of energy deposition in small sites, known as microdosimetry. DOE

**N88-22514#** Rochester Univ., N. Y. Medical Center.  
**STUDIES OF MOLECULAR BIOLOGY Final Report**  
1988 24 p

(Contract DE-FG02-85ER-60281)  
(DE88-005906; DOE/ER-60281/3) Avail: NTIS HC A03/MF A01  
This report is the annual summary for the Studies on Molecular Biology Program of the Biophysics Department of the University of Rochester, Medical Center. Brief summaries of five studies are provided. Each individual study was also abstracted and indexed for the Energy Data Base. DOE

**N88-22515\*#** Lockheed Engineering and Management Services Co., Inc., Washington, D.C.

**USSR SPACE LIFE SCIENCES DIGEST, ISSUE 16**  
LYDIA RAZRAN HOOKE, ed., RONALD TEETER, ed., BETTE SIEGEL, ed., P. LYNN DONALDSON, ed., LAUREN B. LEVETON, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, D. C.) Apr. 1988 124 p  
(Contract NASW-4292)  
(NASA-CR-3922(19); NAS 1.26:3922(19)) Avail: NTIS HC A06/MF A01 CSCL 06C

This is the sixteenth issue of NASA's USSR Life Sciences Digest. It contains abstracts of 57 papers published in Russian language periodicals or presented at conferences and of 2 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. An additional feature is the review of a book concerned with metabolic response to the stress of space flight. The abstracts included in this issue are relevant to 33 areas of space biology and medicine. These areas are: adaptation, biological rhythms, bionics, biospherics, body fluids, botany, cardiovascular and respiratory systems, developmental biology, endocrinology, enzymology, exobiology, gastrointestinal system, genetics, gravitational biology, habitability and environmental effects, hematology, human performance, immunology, life support systems, man-machine systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, reproductive biology, and space biology.

Author

**N88-23363#** Utah Univ., Salt Lake City.  
**BEHAVIOR, PHYSIOLOGY AND ENERGY DEPOSITION IN RATS CHRONICALLY EXPOSED TO 2450 MHZ RADIATION**

J. A. DANDREA and O. P. GANDHI Nov. 1987 149 p  
(Contract EPA-68-02-3456)  
(PB88-171418; EPA-600/1-87-012) Avail: NTIS HC A07/MF A01 CSCL 06C

The research program was initiated to determine both the specific absorption rate (SAR) and the behavioral and physiological consequences of chronic CW microwave radiation exposure at 2450 MHz in the laboratory rat. Whole-body average and local SARs at discrete sites within the body of the rats and mice were determined experimentally using different exposure systems and analytical techniques. The whole-body average SAR and the distribution of SAR within the body depends on a variety of factors; type of exposure system, polarization of the field, size of the animal, and angle of radiation incident on the body. Three experiments were conducted to determine the effects of chronic exposure to 2450 MHz microwave radiation on several measures of rat behavior and physiology. Groups of rats were exposed intermittently to 2450 MHz radiation at power densities of 0.5 mW/sq cm or 2.5 mW/sq cm for 90 days. GRA

**N88-23364#** North Carolina Biotechnology Center, Research Triangle Park.

**NORTH CAROLINA BIOMOLECULAR ENGINEERING AND MATERIALS APPLICATIONS CENTER (NC-BEMAC) Final Report, 1 May 1984 - 31 Oct. 1987**

R. D. BEREMAN, M. A. CRENSHAW, A. L. CRUMBLISS, R. W.

HENKENS, and P. D. RILLEMAN 29 Dec. 1987 26 p  
(Contract N00014-84-C-0183)  
(AD-A190923) Avail: NTIS HC A03/MF A01 CSCL 06A

The overall objective of this program was to initiate a multi-disciplinary and multi-institutional research program involving the innovative application of biotechnology to materials science problems. Techniques for the immobilization and activity characterization of bovine carbonic anhydrase on porous silica beads and graphite rods have been developed. The enzyme immobilized on porous silica beads maintains catalytic activity in nearly anhydrous organic solvents. Polyclonal (rabbit) and monoclonal (murine) antibodies to carbonic anhydrase have been developed for enzyme immobilization applications. We have successfully prepared and characterized several low molecular weight complexes containing low valent transition metals which have potential for binding and activating small, biologically, relevant molecules. Multinuclear variable temperature NMR has been successfully utilized to study the solution dynamics of these complexes. A polyanionic sulfated glycoprotein was isolated from a molluscan shell, combined with various polymeric substrates, and found to induce mineralization at the interface with an aqueous solution. The minerals defined included various forms of calcium carbonate and of calcium phosphate. In order to induce bulk mineralization, strong hydrogels were prepared and seeded with a calcium phosphate microphase and further extensive mineralization was achieved throughout the material. GRA

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### AEROSPACE MEDICINE

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

**A88-37272#**

**A DECREASE OF CLUMPING OF RED CELLS (AND PLATELETS) UNDER ZERO GRAVITY ON STS 51-C - POSSIBLE IMPLICATIONS TO OTHER ZERO GRAVITY INVESTIGATIONS OF CANCER AND HEART DISEASES**

L. DINTENFASS (Sydney, University; Rachel Forster Hospital, Australia) IN: National Space Engineering Symposium, 3rd, Canberra, Australia, June 30-July 2, 1987, Preprints of Papers. Barton, Australia/Brookfield, VT, Institution of Engineers/Brookfield Publishing Co., 1987, p. 196-202. Research supported by the National Heart Foundation of Australia, National Health and Medical Research Council, CSIRO, et al. refs

A study of two-dimensional aggregation of red blood cells under zero gravity, on space shuttle 'Discovery' indicated that morphology of aggregates differs greatly from that observed under 1 g. Blood obtained from patients with cancer or hyperlipidaemia or heart disease showed normal rouleaux formation under zero gravity, but high compact aggregation on the ground. Coincidentally, blood platelets also showed decreased clumping under zero gravity. Subject to future confirmation of these results, it is speculated that zero gravity affects cell-cell interaction and, thus, the architecture of the membrane. Author

**A88-37444**

**MILITARY FLIGHT EXPERIENCE AND SYMPATHO-ADRENAL ACTIVITY**

E. SVENSSON, M. ANGELBORG THANDERZ, L. SJOBERG, and M. GILLBERG (Forsvarets Forskningsanstalt, Stockholm, Sweden) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 411-416. refs

Urine excretion levels of adrenaline (A) and noradrenaline (NA) were determined, and achievement, commitment to the task, difficulty, risk, activation, and tension were rated after the preparation or planning and after the performance of 245 missions by 21 attack pilots. The catecholamine excretion levels increased and the ratio NA/A decreased as a function of condition (lesson,

preparation, and mission). From a confirmatory factor analysis it was found that the catecholamine reactivity during preparation (values corrected for basal activity) was affected by the perceived challenge potential of the mission. The reference A activity covaried with the total A reactivity during the missions, i.e., the higher the basal excretion levels the higher the reactions to the missions. A positive relationship was found between former flight experience (hours) and mean activity of A. The rate of increase of A was potentiated by nicotine. Potential explanations of the increase of A are discussed. Author

A88-37445

**THE VALSALVA MANEUVER AS AN INDIRECT, NON-INVASIVE INDICATOR OF CENTRAL BLOOD VOLUME SHIFT**

JUERGEN STEGEMANN, FRANK M. BAER, and UWE HOFFMAN (Deutsche Sporthochschule, Cologne, Federal Republic of Germany) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 422-427. refs

The objective of this work was to determine whether the Valsalva maneuver may be used as an indicator of fluid shift during spaceflights. The subjects, 21 healthy young men, conducted the maneuver against expiratory pressures of 20, 30, and 40 mm Hg, each lasting 30 s, at vertical, horizontal, and 6-deg head down tilt (HDT) body positions. Heart rate was continuously recorded on a beat by beat basis together with the expiratory pressure. The increase in heart rate at equal intrathoracic pressures was maximal in the vertical position, significantly lower ( $p$  less than 0.001) in the horizontal position, and lowest ( $p$  less than 0.05) in the 6-deg HDT position. Obviously, the blood volume shift in the horizontal and 6-deg HDT position partly compensated the impaired venous return during the Valsalva maneuver. This simple and noninvasive technique might be used to indicate the time course of blood volume shift during the initial stage of an orbital flight. Author

A88-37446

**FIBRINOGENOLYSIS IN THE ABSENCE OF FIBRIN FORMATION IN SEVERE HYPOBARIC HYPOXIA**

PETER BAERTSCH, ANDRE HAEBERLI, KURT HAUSER, ALFRED GUBSER, and P. WERNER STRAUB (Bern, Universitaet; Institute of Aviation Medicine, Duebendorf, Switzerland) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 428-432. refs

The effect of severe hypoxemia on the blood coagulation system was investigated by measuring the fibrinogen degradation products, fragment E and fragment 15-42 of the beta-chain (B-beta 15-42), and the blood coagulation parameters in 15 army pilots before and at the end of 21 min of hypobaric hypoxia (250-310 mm Hg). Hypoxia was found to cause acceleration of thrombin time and euglobulin lysis time, and to increase the factor VIII pre-coagulant activity and the concentrations of betathromboglobulin and fibrinogen degradation products E and B-beta 15-42. On the other hand, the concentration of fibrinopeptide A did not change significantly. The results indicate that severe hypoxemia causes activation of the fibrinolytic system without causing fibrin formation. I.S.

A88-37448

**SLEEP AND CIRCADIAN RHYTHMS OF AN AIRLINE PILOT OPERATING ON THE POLAR ROUTE - A CASE STUDY**

ALEXANDER SAMEL and HANS M. WEGMANN (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 443-447. Research supported by the Bundesministerium fuer Verkehr. refs

This study was planned and performed as a first step to assess sleep behavior and circadian rhythmicity in aircrews operating on regular passenger flights between Germany and Japan via Anchorage, AK. Sleep patterns as well as continuous recordings of ECG and temperature were obtained from a B747 captain during a period of 13 d, including a preceding control day, 8 d on duty and 4 d at home base after return. Sleep behavior and circadian

rhythms changed dramatically due to adverse effects from the duty roster on the polar route. Sleep periods became fragmented into several sleep periods per day in a very irregular manner. Total sleep duration was shortened and sleep deficits occurred between flights. After return to the home base, sleep distribution remained divided into two intervals per day. The circadian system was considerably disrupted on route. Effects associated with irregular duty and sleep patterns intensified desynchronization. Readjustment was extremely slow resulting in a phase-displacement of at least 10 h even after being home for 4 d. Altogether, the results give reason for serious concerns and for the conclusion to strongly recommend more extensive studies on this route. Author

A88-37449\* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**COMPARISON OF AEROBIC FITNESS AND SPACE MOTION SICKNESS DURING THE SHUTTLE PROGRAM**

RICHARD T. JENNINGS, JEFFREY R. DAVIS, and PATRICIA A. SANTY (NASA, Johnson Space Center, Houston, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 448-451. refs

Space motion sickness (SMS) is an important problem for short-duration space flight; 71 percent of STS crewmembers develop SMS symptoms. The search for effective countermeasures and factors that correlate with sensitivity has been extensive. Recently, several investigators have linked aerobic fitness with motion sickness sensitivity in the 1-G or high-G environment. This paper compares the aerobic fitness of 125 Shuttle crewmembers with their SMS symptom category. Aerobic fitness data were obtained from the exercise tolerance test conducted nearest the time of launch. SMS data were derived from the medical debrief summaries. Mean maximum oxygen consumption values for crewmembers in four SMS categories (none, mild, moderate, severe) were 44.55, 44.08, 46.5, and 44.24 ml/kg per min, respectively. Scattergrams with linear regression analysis, comparing aerobic fitness and SMS symptom classification are presented. Correlation coefficients comparing SMS categories vs. aerobic fitness for men and women reveal no definite relationship between the two factors. Author

A88-39920

**THE POSSIBILITIES OF THE CORRELATIONAL RHYTHMOGRAPHY METHOD FOR THE ASSESSMENT OF PILOTS' PREFLIGHT CONDITION [VOZMOZHNOСТИ METODA KORRELIATSIONNOI RITMOGRAFI I V OTSENKE PREDSTARTOVOGO SOSTOIANIIA LETCHIKOV]**

G. N. GRECHIKHIN, V. G. DOROSHEV, and V. V. GRISHCHENKO Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1988, p. 36-38. In Russian.

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

A88-39921

**STUDY OF MICROCIRCULATION IN SEAMEN DURING A LONG VOYAGE [IZUCHENIE MIKROTSIRKULIATSII U MORIAKOV V DLITEL'NOM PLAVANII]**

V. M. BEREZIN, S. V. OKHOTNIKOV, and A. A. POVAZHENKO

Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1988, p. 38-40. In Russian.

The effect of stress induced by a long sea-voyage on the state of seamen's circulation was assessed in 67 marine specialists by examining in these subjects the condition of the conjunctiva and the nail-bed capillaries by the methods of biomicroscopy and capillaroscopy, respectively. The physical-load tolerance of capillaries was assessed using a bicycle ergometer; the work capacity of subjects was estimated using various sensorimotor reactions. The nature of the microcirculatory changes in the subjects was found to be polymorphic and depended on the overall condition of the seamen and on the nature of their daily activity. The recorded abnormalities included morphological changes of the capillaries, lowering of vessel resistivity to mechanical and physical loads, disrupted microhemodynamics, and changes in the rheological characteristics of blood. I.S.

**A88-39997**  
**GRADED CUTANEOUS VASCULAR RESPONSES TO DYNAMIC LEG EXERCISE**

W. FRED TAYLOR, JOHN M. JOHNSON, WOJCIECH A. KOSIBA, and C. M. KWAN (Texas, University, San Antonio) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, May 1988, p. 1803-1809. refs  
(Contract NIH-HL-20663)

The effect of leg exercises of various intensity on control of skin blood flow (SkBF) was investigated by examining cutaneous vascular responses of human subjects to leg exercise at five work loads in the 75-200 W range. Laser-Doppler velocimetry was used to provide a continuous linear index of SkBF that is independent of the blood flow to underlying forearm muscle. Local warming to 39 C at the site of measurement of SkBF provided a consistent skin temperature and facilitated observation of changes in laser-Doppler flow signal. Mean arterial pressure was measured to calculate the cutaneous vascular conductance (CVC). It was found that the internal temperature at which CVC began to rise during exercise (CVC threshold) was graded with work load beyond 125 W. In that range, the CVC threshold increased by 0.16 C for every increment of 25 W. I.S.

**A88-39998**  
**CHARACTERISTICS OF THE UPPER AIRWAY PRESSURE-FLOW RELATIONSHIP DURING SLEEP**

DAVID W. HUDGEL, CURTIS HENDRICKS, and HERBERT B. HAMILTON (Case Western Reserve University, Cleveland; Cleveland Metropolitan General Hospital, OH) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, May 1988, p. 1930-1935. refs  
(Contract NIH-HL-33712)

This paper presents a mathematical model that defines the inspiratory pressure-flow relationship of the upper airway during sleep and identifies the segment of airway responsible for the sleep-related flow limitations. The pressure-flow relationship data were obtained from the results of the measurements of nasal and total supralaryngeal pressure and flow during wakefulness and stage-2 sleep in five healthy subjects lying supine. It was found that, during sleep, the hyperbolic equation formulated to fit the experimental data was superior to that of the Rohrer equation (1915), while during wakefulness the fit of the hyperbolic equation was equivalent to or better than that of the Rohrer equation. The flow-limiting segment, was found to be located within the pharyngeal airway, not in the nose. I.S.

**A88-40500**  
**SLEEP AND CIRCADIAN RHYTHMS OF TEMPERATURE AND URINARY EXCRETION ON A 22.8 HR 'DAY'**

DAVID MINORS, JAMES WATERHOUSE (Manchester, Victoria University, England), K. HUME (Manchester Polytechnic, England), M. MARKS (Sussex, University, Brighton, England), JOSEPHINE ARENDT (Surrey, University, Guildford, England) et al. *Chronobiology International* (ISSN 0742-0528), vol. 5, 1988, p. 65-80. refs

The contribution of the exogenous components, such as a

rhythmic environment and the rhythmicity of habits, to measured circadian rhythms was determined by studying six human subjects living in an isolated chamber on a 22.8-h 'day'. The quantity and quality of sleep were measured, and the deep-body temperature profiles associated with sleep were assessed. In addition, analysis of circadian rhythmicity in urinary variables (K, Na, Ca, phosphate, and a metabolite of melatonin) was performed. A disturbance of sleep was experienced by all subjects, with the slow-wave sleep disturbances least marked. In general, it was found that the 22.8-h days affected subjects differently. These differences were interpreted as indicating that the endogenous component of circadian rhythm of three of the subjects adjusted to the 22.8-h 'days', but that the other three subjects were not entrained. The reason for this difference is, at present, not known. I.S.

**A88-40857#**  
**MECHANISMS OF LIQUID MOTIONS IN THE INNER EAR CANALS AND THE PROBLEM OF EQUILIBRIUM [MEKHANIKA KRETANJA TEHNOSTI U KANALIMA UNUTRASHNJE UVA I PROBLEM RAVNOTEZHE]**

M. NENADOVICH, M. SIMONOVICH, and V. DJORDJEVICH *Srpska Akademija Nauka i Umetnosti, Glas, Odeljenje Tehnichkih Nauka*, no. 25, 1987, p. 1-44. In Serbo-Croatian. refs

An interdisciplinary approach to the study of liquid motions in the semicircular canals and corresponding excitations in related sensory structure is developed on the basis of medical, experimental, and mathematical investigations. Good agreement was found between electronystagmographic evaluations of different vestibular excitations obtained on rotating chairs, the mechanical characteristics of moving parts in the canals, and liquid-flow equations. The results are pertinent to the study of variable acceleration forces important for the problem of equilibrium in different conditions of space flight. B.J.

**A88-40986**  
**CREW WORKLOAD IN JASDF C-1 TRANSPORT FLIGHTS. I - CHANGE IN HEART RATE AND SALIVARY CORTISOL**  
YUKIKO KAKIMOTO, AKIO NAKAMURA, HIDEO TARUI, YUKO NAGASAWA, and SHIGEYUKI YAGURA (Air Self-Defense Force, Aeromedical Laboratory, Tokyo, Japan) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, June 1988, p. 511-516. refs

The physiological responses of heart rate and salivary cortisol for six paired captains and copilots during JASDF scheduled transport flights were compared to assess crew workload. The relative change of both responses showed similar patterns; the responses were influenced significantly by whether pilots were controlling the aircraft. Moreover, differences in flying experience and responsibility of captains and copilots influenced the two physiological responses; heart rate and salivary cortisol measures increased more for both captains and copilots while they were in control of the aircraft than when they were not. Compared to captains, copilots showed much higher activation and variability in relative change of heart rate and salivary cortisol between periods of controlling and noncontrolling the aircraft. On the other hand, captains showed relatively constant responses comparing aircraft controlling and noncontrolling periods, especially in the cruise phase of flight. Salivary cortisol may be a useful, noninvasive method of assessing crew workload. Author

**A88-40987**  
**RECOVERY FROM GZ-INDUCED LOSS OF CONSCIOUSNESS - PSYCHOPHYSIOLOGIC CONSIDERATIONS**

ESTRELLA M. FORSTER and JAMES E. WHINNERY (Rothe Development, Inc., San Antonio; USAF, School of Aerospace Medicine, Brooks AFB, TX) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, June 1988, p. 517-522. refs

Eight healthy male volunteer members of the USAFSAM acceleration panel were exposed to two consecutive acceleration runs of +1 Gz to +7 Gz at 6 G/s onset rates. The subjects were instructed to relax during the acceleration exposure in order to voluntarily induce loss of consciousness (LOC). The subjects

were asked to relate dreams, thoughts, or other mental illusions experienced during G-LOC episodes. Most subjects were amused and surprised, as well as interested in, relating their experience, although they were embarrassed about the G-LOC episode itself. Early post-G-LOC transient paralysis, as well as late LOC myoclonic (flailing) movements, were evident. Heart-rate response to the acceleratory stress was uneventful; maximum heart rate occurred 3.2 s after the onset of LOC. The study of dreams during normal sleep stages has been reviewed by many investigators, but this research has not extended to acceleration/hypoxic types of unconsciousness where dreams also seem to occur. G-LOC dream-state analysis, post-G-LOC paralysis, and their possible repercussions upon performance and incapacitation periods should be investigated, not only as curious events, but as operationally important and psychophysiological significant. Author

**A88-40988****SOME EFFECTS OF SLEEP LOSS ON VESTIBULAR RESPONSES**

WILLIAM E. COLLINS (FAA, Civil Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 523-529. refs

The effect of 55-h-long sleep loss on the vestibular responses (nystagmus and motion sensations) of human subjects to simple angular clockwise acceleration and Coriolis-type vestibular stimulation (rightward 30-deg head tilts during the clockwise rotation), performed in darkness in an enclosed Still-Werner rotating device, was investigated together with the effect of d-amphetamine. With regard to the simple angular stimulus, the loss of sleep had a negligible effect on quantified experiences of turning and no effect on fast-phase nystagmus until sometime between 30-50 h of sleep deprivation; there was, however a general decline in slow-phase and duration measures of nystagmus. Coriolis stimulation produced a pattern of nystagmus that was similar to, but more exaggerated than, the pattern obtained from angular accelerations. Amphetamine had no consistent effect on responses of control subjects; in the sleep-deprived subjects, d-amphetamine significantly increased nystagmus and elevated (but not significantly) the measures of turning experiences of the sleep-deprived subjects. I.S.

**A88-40990****INSTRUMENT FLIGHT PERFORMANCE UNDER THE INFLUENCE OF CERTAIN COMBINATIONS OF ANTIEMETIC DRUGS**

FRED C. HYMAN, WILLIAM E. COLLINS, HENRY L. TAYLOR, EDWARD F. DOMINO, and ROBERT J. NAGEL (Illinois, University, Savoy; FAA, Civil Aeromedical Institute, Oklahoma City, OK; Michigan, University, Ann Arbor) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 533-539. refs  
(Contract F33615-83-K-0612)

Two different combinations of antiemetic drugs were evaluated using a digital flight simulator. Drug treatments consisted of a lactose placebo, a combination of thiethylperazine (10 mg) and cimetidine (300 mg), and a combination which added promethazine (25 mg) to the two-drug combination. The performance effects of these combinations were evaluated on both a dual task (instrument flight task with the Sternberg Memory Scanning task) and a single task condition (Sternberg task only) for 3 h post drug ingestion. Analysis indicated a significant treatment effect on three of the six flight performance variables and that the three-drug combination, containing promethazine, was primarily responsible for the decrease in performance. Implications for operation in a radiation environment are that thiethylperazine and cimetidine will not cause significant performance decrements, but the addition of promethazine to these two drugs will significantly impair performance. The Sternberg task was sensitive to changes in workload. Author

**A88-40992****CONTRIBUTION OF EXERCISE AND SHIVERING TO RECOVERY FROM INDUCED HYPOTHERMIA (31.2 C) IN ONE SUBJECT**

GERALD K. BRISTOW and GORDON G. GIESBRECHT (Manitoba, University, Winnipeg, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 549-552. refs

**A88-40993****CLINICAL APPLICATION OF TYMPANOMETRY IN AVIATORS**  
ZHEN-MING TIAN (General Hospital of the Air Force, Beijing, People's Republic of China) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 559-562. refs

The effectiveness of tympanometry as a clinical procedure for determining the status of the middle ear and of the eustachian tube function was investigated in 274 aviators, of which 174 were normal, 40 had acute aerotitis media, and 60 had chronic aerotitis media. Pure tone audiometry was performed using audiometer; impedance audiometry was carried out using an electroacoustic impedance bridge to obtain tympanography and static compliance for each ear; and an altitude chamber test, consisting of decompression to a pressure corresponding to an altitude of 4 km at the rate of 30 m/s, was performed followed by an otoscopic examination of tympanic membranes. The results show that most normal aviators and patients with chronic aerotitis media in remission had a type-A tympanogram (as classified by Jerger), whereas patients with acute aerotitis media had type-B or type-C tympanograms. Patients with chronic aerotitis media were found to respond abnormally to inflation-deflation tests. I.S.

**N88-22237#** Joint Publications Research Service, Arlington, Va.  
**PROTECTION AGAINST LASER DAMAGE TO HUMAN BODY REVIEWED**

BINGYU YAN *In its* JPRS Report: Science and Technology. China p 17-23 11 Dec. 1987 Transl. into ENGLISH from Yingyong Jiguang (Shanghai, Peoples Republic of China), v. 7, no. 4, Aug. 1987 p 172-176  
Avail: NTIS HC A06/MF A01

Lasers can cause damage to the human eye. The main points of protection against laser damage are described. The proper use of lasers is given along with the protection against bodily damage. E.R.

**N88-22516#** Tracer Technologies, Inc., Somerville, Mass.  
**A LASER-BASED PHOTOACOUSTIC SPECTROMETER FOR DIRECT BREATH C-13O2/C-12O2 MEASUREMENT Final Report**

F. WALSH Aug. 1987 38 p  
(Contract DE-FG02-85ER-60344)  
(DE88-004915; DOE/ER-60344/1) Avail: NTIS HC A03/MF A01

The use of C-13 enriched tracers in health care settings has been limited despite repeated scientific validation and practical application advantages. One limitation has been the absence of a low-cost, operator-easy instrument for the measurement of the extent of C-13 enrichment of samples obtained after ingestion or injection of C-13 enriched tracers. Under DOE Contract DE-AC02-82ER-60063, tracer demonstrated that a laser-based photoacoustic spectrometer could be used to accurately measure CO<sub>2</sub> content in gases. The objective of the present program was to test whether such an instrument could be used to accurately measure C-13 enrichment in CO<sub>2</sub> in breath samples. Under the present program, tracer designed and made a dual-chamber resonant spectrophone coupled with a computer-based data acquisition and analysis system. The laser used to drive the spectrophone was a rf-modulated CO<sub>2</sub> laser with C-13O<sub>2</sub> fill. The data obtained under the program demonstrated that the laser-based photoacoustic spectrophone is capable of accurate measurement of breath samples; however, the precision in the measurement of specific samples is not sufficient to warrant the use of this instrument in health care settings. DOE

**N88-22517#** Nevada Univ., Las Vegas.  
**EVALUATION OF EXISTING TOTAL HUMAN EXPOSURE MODELS**

M. D. PANDIAN Dec. 1987 94 p

(Contract EPA-R-812189)  
(PB88-146840; EPA-600/4-87-044) Avail: NTIS HC A05/MF A01  
CSCL 06P

A special class of models is examined and several existing formulations are compared. These models use pollutant concentration distributions and human time-activity patterns, methods of matching concentrations and activities, the number of pollutants that can be handled, accommodation of short-term and long-term exposures, treatment of uncertainties and errors in modeling techniques. Models are also compared to ascertain whether the computer program itself is well written. Author

**N88-22518#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

**MOTION SICKNESS: QUANTITATIVE, ALGORITHMIC  
MALAISE INDICATION IN REAL TIME M.S. Thesis**

EDWARD L. FIX Dec. 1987 109 p  
(AD-A189674; AFIT/GE/ENG/87D-18) Avail: NTIS HC A06/MF  
A01 CSCL 06J

Physiological data were collected on human volunteers to study the effects of motion sickness. Data were analyzed and correlated using least squares curve fitting and other statistical methods that are described. An equation is developed that relates five separate physiological signals to subjective motion sickness. A computer program is presented and described which takes the physiological signals in real time and computes the motion sickness. A pattern recognition type of approach which uses a neural net is presented and discussed as an alternative to the equation model. The two models are compared. This disorder is characterized by a variety of symptoms; the most prevalent are nausea, pallor, sweating, and vomiting. Other possible symptoms include salivation, feeling of warmth, light-headedness, depression or apathy, yawning and drowsiness, belching or flatulence, headache, and occasionally hyperventilation. They are brought on by unusual or provocative motion stimulus, either real or perceived. The leading theory about the mechanism of motion sickness is the sensory conflict theory. It says that when there is a conflict between different parts of the balance system, motion sickness can result. GRA

**N88-22519#** Krug International, San Antonio, Tex. Technology Services Div.

**A COMPARISON OF VISUAL EVOKED POTENTIAL AND  
BEHAVIORAL MEASURES OF FLASHBLINDNESS IN HUMANS  
Final Report, Sep. 1985 - Oct. 1986**

FRED H. PREVIC and RALPH G. ALLEN Sep. 1987 17 p  
(Contract F33615-84-C-0600)  
(AD-A189757; USAFSAM-TR-87-21) Avail: NTIS HC A03/MF  
A01 CSCL 06J

A comparison between visual evoked potential (VEP) and behavioral measures of flashblindness following exposure to intense but eyesafe xenon flashes was performed. The purpose was to further validate the animal model of laser flashblindness based on VEP recordings in anesthetized rhesus monkeys. Monopolar VEPs were recorded from the posterior scalp of six human subjects in response to square-wave gratings of three differential spatial frequencies. The VEPs were recorded prior and subsequent to the presentation of a 125-ms, 7, 3 log td-s xenon flash. The results showed that the moment of initial post-flash visibility of the grating as assessed by the VEP's recovery above its baseline was highly comparable to that measured behaviorally. This comparison was demonstrated more clearly in the group data than in data obtained from individual subjects, suggesting that the predictive ability of the VEP depends in part on its signal-to-noise ratio. In general, the assumptions underlying the animal flashblindness model are largely supported by the high correlations between predicted and obtained recovery estimates in this study and previous monkey studies. GRA

**N88-22520#** Wisconsin Univ., Milwaukee. Dept. of Psychology.  
**MECHANISMS MEDIATING PERCEPTION OF COMPLEX  
ACOUSTIC PATTERNS Final Report, 1 Aug. 1986 - 30 Jul.  
1987**

RICHARD M. WARREN 20 Nov. 1987 4 p

(Contract AF-AFOSR-0304-86)  
(AD-A189765; AFOSR-87-1636TR) Avail: NTIS HC A02/MF A01  
CSCL 05H

Five items of equipment were acquired under this instrumentation grant: a filter system for audio waveforms, a two channel audio synthesizer, a two track recorder, a two channel Fast Fourier Transformation (FFT) system, and a sound spectrograph. All are used in a laboratory devoted to the relationship between acoustic features and auditory perception. GRA

**N88-22521#** Brigham and Women's Hospital, Boston, Mass.  
**A PROGRAM FOR THE STUDY OF SKELETAL MUSCLE  
CATABOLISM FOLLOWING PHYSICAL TRAUMA Annual  
Report, Sep. 1982 - Sep. 1984**

DOUGLAS W. WILMORE 6 Dec. 1987 42 p  
(Contract DAMD17-81-C-1201)  
(AD-A189771) Avail: NTIS HC A03/MF A01 CSCL 06O

The purpose of this work was to attenuate skeletal muscle proteolysis in the post-traumatic period. In the initial study, amino acid solutions were administered with or without glutamine supplementation. Amino Acid administration at the dose of 0.624 grams nitrogen kg hour was associated with near nitrogen balance, maintenance of skeletal muscle intracellular stores, and attenuation of hind-quarter nitrogen loss. In additional studies, adrenergic blockade was achieved by administering phentolamine and propranolol or utilizing high epidural anesthesia. While blockade did not reduce nitrogen excretion in the posttraumatic period, nitrogen efflux from the hind-quarter was markedly attenuated. This is the first demonstration of a relationship between the adrenergic nervous system and accelerated proteolysis. The significance of these findings is discussed. GRA

**N88-22522#** Yale Univ., New Haven, Conn. School of Medicine.

**LABORATORY EQUIPMENT UPDATE Final Report, 1 Sep.  
1986 - 31 Aug. 1987**

JOY HIRSCH 31 Oct. 1987 14 p  
(Contract AF-AFOSR-0308-86)  
(AD-A189781; AFOSR-87-1728TR) Avail: NTIS HC A03/MF A01  
CSCL 06D

We have digitized the cone centers of a primate and a human photoreceptor lattice and have determined that the Nyquist limit predicts visual resolution out to nearly two degrees of retinal eccentricity. Beyond 2 degrees lattice disorder appears to have a deleterious factor between cone density and aperture size. A developing model of lattice structure and design strategies reflects complex principles involved in the evolution of human spatial vision. We are currently exploring a bottom up model of human vision where sampling limitations are propagated along the spatial vision processing hierarchy. The observations that this model addresses include a new class of two dimensional spatial discriminated more accurately than the bisection of two points of comparable separation. This discovery has led to the development of two additional lines of research, area discrimination and dot density discrimination. We have identified a fundamental similarity between spatial frequency discrimination and vernier acuity that demonstrates that Weber's Law applied similarity to both tasks. Further, we have shown that two-dot vernier discrimination falls off within two degrees of retinal eccentricity similarly to changes in retinal sampling. These findings contribute to a model of spatial discriminations that includes limits imposed at the sampling level of the visual process. GRA

**N88-22523#** Loyola Univ., Chicago, Ill. Hearing Inst.  
**COMPLEX SOUND PROCESSING: AN INTERDISCIPLINARY  
APPROACH Final Report, 1 Oct. 1986 - 1 Oct. 1987**

WILLIAM A. YOST, RICHARD R. FAY, and WILLIAM SHOFNER  
10 Nov. 1987 4 p  
(Contract AF-AFOSR-0054-87)  
(AD-A189782; AFOSR-87-1931TR) Avail: NTIS HC A02/MF A01  
CSCL 06D

Complex sounds describe most of the sounds that are

perceived in our everyday life. However, most of our present knowledge is about the neural process of simple sounds. More knowledge is required about the neural processing of complex signals and about how animals process similar complex sounds. This proposal was to purchase two real-time, high-speed data acquisition computers similar to the one used for the human perception research at the Parly Hearing Institute. These computers, MASSCOMPs, will be used to generate stimuli and to analyze behavioral and neurophysiological response. The research in these projects involves the human perception of complex stimuli, and combined animal behavior and neurophysiological measures of some of these stimuli, and combined animal behavior and neurophysiological measures of some of these stimuli. The physiological studies include measurements within the eighth nerve and at the level of the cochlear nucleus of the auditory system. In order to relate these measures to the animal's ability to process these stimuli a series of animal behavioral studies are described. The addition of these computer was essential for the full benefit of a multidisciplinary study of the processing of complex sounds.

GRA

**N88-22524#** Indiana Univ., Bloomington. Bloomington Hearing and Communication Lab.

**PERCEPTION OF COMPLEX AUDITORY PATTERNS Final**

**Report, 1 Sep. 1984 - 31 Aug. 1987**

CHARLES S. WATSON 2 Nov. 1987 45 p

(Contract AF AFOSR-0337-84)

(AD-A190218; AFOSR-87-1781TR) Avail: NTIS HC A03/MF A01 CSDL 06D

This project continued and extended a series of experiments on the discrimination and identification of complex auditory patterns. The general purpose of this work is to determine the limits of human listeners' abilities to extract information from complex sounds including, but not limited to, those with temporal and spectral properties approximating speech. Experiments used criterion-controlled psychophysical methods in which listeners were trained until approaching asymptotic performance in various discrimination and identification tasks. Advances were made in the following areas: (1) the spectral and temporal range of selective auditory attention; (2) the time course of auditory perceptual learning; (3) informational limits on pattern discrimination; (4) listeners' abilities to learn to attend to multi-tone targets within longer patterns; (5) individual differences in auditory sensitivity, and (6) the perception of spectrally complex sound, including speech and non-speech sounds.

GRA

**N88-22525#** Naval Health Research Center, San Diego, Calif. **NAPPING AND HUMAN FUNCTIONING DURING PROLONGED WORK Interim Report**

PAUL NAITOH and ROBERT G. ANGUS 30 Apr. 1987 41 p

(AD-A190228; NHRC-87-21) Avail: NTIS HC A03/MF A01

CSDL 06J

In prolonged work periods, men and women often forego satisfying their sleep need to complete their assigned jobs, resulting in an accumulation of performance/mood degrading sleep loss and fatigue. Sleep need can be satisfied only by a slow process of sleeping for an average of 7 to 8 consecutive hours per 24 hour period, i.e., a long period of time-out. However, sleep management suggests that recovery from fatigue and sleepiness during a prolonged work period can be accomplished by short or ultra-short sleep (naps) taken during a prolonged work period. Naps are shown not only to refresh and restore human functioning, but also to maintain performance and mood during a prolonged work period. In this paper, naps power as a counter-degradation measure are described first through the literature review, and then through critical evaluation of studies conducted at the Defense and Civil Institute of Environmental Medicine, Canada and the Naval Health Research Center.

GRA

**N88-22526#** Naval Health Research Center, San Diego, Calif. **PREDICTION OF PHYSICAL FITNESS: ESTIMATED PERCENT BODY FAT USING BODY CIRCUMFERENCES VERSUS WEIGHT-HEIGHT MEASURES Interim Report**

KEITH A. PETERSON, TERRY A. CRONAN, and TERRY L. CONWAY 30 Jun. 1987 17 p

(AD-A190233; NHRC-87-25) Avail: NTIS HC A03/MF A01

CSDL 06D

Weight-height indices with an estimate of percent body fat based on a few circumference measurements are compared. The utility of alternative obesity/overfatness measures was assessed by comparing the strength of their associations with several measures of physical fitness, including a 1.5-mile run/walk, 2-minute sit-ups test, sit-reach flexibility test, and an average fitness score. Study participants included 5710 Navy men and 477 Navy women. For men, percent body fat estimated from circumference measures predicted all the components of physical fitness significantly better than any of the weight-height indices. For women, estimated percent body fat was a significantly better predictor of two of the four fitness measures. Overall, the pattern of associations between physical fitness and both the estimated percent body fat and the weight-height measures was similar for men and women; however, the correlations between the percent fat and the fitness measures were stronger for men. These findings suggest that the Navy's procedure for estimating fatness using circumference measures provides a better screen for physical fitness than would any of the commonly used indices.

GRA

**N88-22527#** Naval Health Research Center, San Diego, Calif. **DIETARY FACTORS RELATED TO PHYSICAL FITNESS Interim Report**

LINDA J. DUTTON and TERRY L. CONWAY 30 Sep. 1987

33 p

(AD-A190272; NHRC-87-28) Avail: NTIS HC A03/MF A01

CSDL 06H

This study examined the relationship between habitual dietary practices and performance on the physical readiness test required of all activity duty Navy personnel (OPNAV6110.1B). Participants were 1013 men (mean age = 26.2 years) stationed aboard 9 Navy ships. The men completed a self report survey of lifestyle and dietary habits and were evaluated on four tests of physical fitness: 1.5-mile run, situps, sit-reach, and percent body fat. A standardized overall fitness score was also computed for each person. Results indicated that the participants tend to skip breakfast, ingest moderate amounts of caffeine, and favor a high-fat, low-fiber diet. Fitness scores were associated with a number of dietary variables, including caffeine intake, between-meal snacking, and overeating (all negatively related to fitness), and having a general nutrition orientation (positively related to fitness). Diet was a significant predictor of fitness, even after controlling for age, exercise, and smoking.

GRA

**N88-22528#** Defence Research Establishment, Ottawa. (Ontario).

**ANTHROPOMORPHIC PHANTOM RADIATION DOSIMETRY AT THE NATO STANDARD REFERENCE POINT AT ABERDEEN PROVING GROUND**

T. COUSINS and L. P. RUSHTON Apr. 1987 30 p

(AD-A190508; DREO-968) Avail: NTIS HC A03/MF A01 CSDL 06G

As part of the NATO Dosimetry Intercomparison Project, a series of experiments were conducted at Aberdeen Proving Ground in September 1986 in order to determine neutron and gamma-ray doses delivered to various internal and external locations on an anthropomorphic phantom from a fission source. Thus, the effect of such parameters as self-shielding by the body on dosimeter reading may be determined. The results will be used eventually to validate computer simulations of the Aberdeen environment in order to understand completely the correlation between dosimeter reading and bone marrow dose, or other parameters relating to performance decrement.

GRA

**N88-22529#** Central Inst. for the Deaf, St. Louis, Mo. **AUDITORY PERCEPTION OF COMPLEX SOUNDS Final Technical Report, 1 Sep. 1984 - 31 Aug. 1987**

HIRSH, IRA J. 30 Oct. 1987 18 p

(Contract AF-AFOSR-0335-84)  
(AD-A190528; AFOSR-87-1772TR) Avail: NTIS HC A03/MF A01  
CSCL 06D

The studies summarized in this report concern auditory perceptual processes that underlie aspects of complex pattern recognition, whether, of speech, of music, or of environmental sounds. These patterns differ from each other according to the characteristics of individual sound events and also characteristics of the pattern sequences themselves. Among the sound characteristics, the focus is on pitch, quality and duration. It is found that *spectral properties of complex tones can be changed to yield changes in both apparent pitch and quality, that individuals differ with respect to relative performance on those dimensions, and that both pitch and quality or timbre can play similar grouping roles in auditory systems.* Most of the experimental work has concerned timing of successive sounds in sequences. It is found that at slow rates, listeners detect equally well small temporal offsets or jitters at different positions in the sequence. Increasing the frequency of one of the tones, or increasing the duration of one or two of the successive intervals produces changes in performance at or near the changes. Some of these timing effects are also manifest in the rhythmic aspects of spoken sentences.

GRA

**N88-22530#** Rutgers - The State Univ., New Brunswick, N. J.  
**SELECTIVE MECHANISMS IN AUDITORY AND BIMODAL SIGNAL PROCESSING** Final Scientific Report, 15 Jul. 1983 - 31 May 1987

E. KOWLER, S. STERNBERG, and R. M. MULLIGAN 27 Oct. 1987 36 p  
(Contract AF-AFOSR-0206-83)  
(AD-A190529; AFOSR-87-1773TR) Avail: NTIS HC A03/MF A01  
CSCL 05B

The purpose of this research program was the investigation of mechanisms of attention in auditory and bimodal information processing. The manner in which division of attention influences three stages of information processing, stimulus coding, decision making, and response selection, was described previously by the principle investigator in a general, quantitative theory of attention. Previous work had shown that, within the framework of this theory, the effects of division of attention on the first two stages could be separately identified. As in the earlier research, the work reported here has focused on two key issues: what are the decision processes involved in combining information from two or more sources, and what division of attention degrades the information obtained from each source (i.e., does it result in losses of information at the coding stage).

GRA

**N88-22531#** Federal Aviation Administration, Washington, D.C.  
Office of Aviation Medicine.

**AGE, ALCOHOL, AND SIMULATED ALTITUDE: EFFECTS ON PERFORMANCE AND BREATHALYZER SCORES**

WILLIAM E. COLLINS and HENRY W. MERTENS Jan. 1988 20 p  
(AD-A190642; DOT/FAA/AM-88/2) Avail: NTIS HC A03/MF A01  
CSCL 06K

Trained men in two groups, 30 to 39 (n=12) and 60 to 69 (n=13), each performed at the Multiple Task Performance Battery (MTPB) in four separate full-day sessions with and without alcohol (2.2 mL of 100-proof vodka per kg of body weight) at ground level and at a simulated altitude of 12,500 ft (3810 m). Subjects breathed appropriate gas mixtures through oxygen masks at both ground level and altitude. Mean breathalyzer readings peaked near 88 mg percent and did not differ between age groups or altitude conditions. Younger subjects performed better than older subjects; performance of both age groups was significantly impaired by alcohol, but these adverse effects were greater for the older subjects. No significant effects on performance were obtained due to altitude or to the interaction of altitude with alcohol. These results and those from several other studies suggest that prevalent views regarding the nature of the combined effects of alcohol and altitude on blood levels and on performance need to be redefined.

GRA

**N88-22532#** Technische Hogeschool, Eindhoven (Netherlands).  
**METHODS OF MEASUREMENT FOR THE EVALUATION OF MONOLAYER PROPERTIES. DEVELOPMENT AND APPLICATIONS** Ph.D. Thesis

PAULUS MARIA CORNELI GIELES 1987 175 p  
(ETN-88-92229) Avail: NTIS HC A08/MF A01

In order to understand the role of lung surfactant and its components, and in order to develop criteria for an artificial surfactant or for the maturity of lung surfactant, methods of measurement were studied. Four methods, concerned with the *physico-chemical properties of surfactant, and which establish the interfacial tension to surface area relation (sigma-A)* are described: the Langmuir-Wilhelmy method; asymmetric method; Benjamins-de Feijter method; and oscillating bubble method. It is argued that drawing conclusions about the in-vivo behavior of lung surfactant from sigma-A measurements is not justified.

ESA

**N88-23039#** Joint Publications Research Service, Arlington, Va.  
**EXPERIMENTAL RESEARCH ON SKIN REFLECTION, TRANSMISSION, ABSORPTION OF LIGHT RAYS**

JIANMIN TANG and CHANGYU FU *In its* JPRS Report: Science and Technology. China p 32-39 14 Jan. 1988 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, People's Republic of China), v. 14, no. 2, 20 Jul. 1987 p 435; 440-443  
Avail: NTIS HC A07/MF A01

A 50 W tungsten halogen lamp was used in an experimental apparatus designed to measure the absorbability, reflectivity, and transmissivity of human skin with respect to light. Tests were made on free skin, living fingers, and skin plus subcutaneous tissue. It was found that when light impinges on the human body, reflection occurs not only at the skin surface but also in the layers inside the skin and in the subcutaneous tissue. As light penetrates, if it collides with blood, then the reflectivity and transmissivity curves exhibit absorption peaks identical to blood. When skin or human bodies are illuminated, the variation tendencies in reflectivity and transmissivity are respectively the same. These results point to the conclusion that future research should deal with whole structures rather than single tissue layers. For whole-body illumination, the following propositions are supported: (1) between 400 and 800 nm, the variational tendencies of the maximum reflectivity curve are fundamentally the same; (2) in that range, the maximum reflectivity curve has the same absorption peaks as for blood; and (3) reflectivity is lowest and absorption highest with respect to violet light.

Author

**N88-23365#** Rice Univ., Houston, Tex. Dept. of Physics.  
**STUDIES OF MODEL ION CHANNELS IN DEFECT-FREE MULTIBILAYERS OF PHOSPHOLIPIDS** Annual Report, Oct. 1986 - Sep. 1987

HEUY W. HUANG 15 Nov. 1987 4 p  
(Contract N00014-86-K-0087; DA PROJ. RR0-4108)  
(AD-A188740) Avail: NTIS HC A02/MF A01 CSCL 06A

Model ion channels such as gramicidin, melittin and alamethicin exhibit functional similarities to physiological channels, including voltage-gating, selectivities, activation and inactivation. A great deal is known about the functional (electrical) properties of model channels, but with the exception of gramicidin (which is not a voltage-gated channel) little progress has been made in determining the structures of the channels in membrane. We have developed a technique of preparing defect-free lipid multibilayers with ion channels embedded in them, so that spectroscopic and scattering measurements of aligned ion channels in electric field can be made. CD studies of alamethicin channels showed the important orientation effect of helical peptides on CD and conformation changes of the channel with sample conditions.

GRA

**N88-23366#** Technische Hogeschool, Eindhoven (Netherlands).  
**DYNAMIC PROPERTIES OF HUMAN BRIGHTNESS PERCEPTION** Ph.D. Thesis

HUIB DERIDDER 1987 136 p Sponsored by the Netherlands Organization for the Advancement of Pure Research  
(ETN-88-92243) Avail: NTIS HC A07/MF A01

Brightness-scaling and brightness-matching experiments are

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described. Results suggest a stable monotonic relation between brightness and luminance. A dynamic brightness model proves able to describe the influence of flash duration on this brightness-luminance relation, suggesting that the dynamic brightness model can predict the perceived brightness of relatively fast-changing stimuli. A 1 deg field with dark surround was employed to determine the temporal impulse response of the transient channel, using agitation as detection criterion. The Broca-Sulzer effect was measured against an extended background by brightness matching and/or scaling. The finding that the Broca-Sulzer effect is predicted from the impulse response suggests that the same mechanism (transient channel) is involved. Under certain conditions the time constants of the visual system are smaller for 1 deg fields flashed against a dark background than for those flashed against a photopic background. ESA

**N88-23367#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Flugmedizin.

### **LEG VOLUME CHANGE UNDER LOWER BODY NEGATIVE PRESSURE (LBNP) IN DEPENDENCE ON STRATIFICATION** **Ph.D. Thesis - Technische Hochschule**

ANNA MUELLER Nov. 1987 78 p In GERMAN; ENGLISH summary

(DFVLR-FB-87-47; ISSN-0171-1342; ETN-88-92319) Avail: NTIS HC A05/MF A01; DFVLR, VB-PL-DO, 90 60 58, 5000 Cologne, Fed. Republic of Germany, 28 DM

Ten male volunteers were used to study the reaction of peripheral circulation to lower body negative pressure (LBNP) in dependence on the stratification of the leg. The LBNP was applied in four different leg stratifications with increasing inflexion in hip and knee joint. Ultrasound plethysmography, peripheral vein pressure, light-reflexion rheography, count of erythrocytes, hematocrit, hemoglobin, and caffiethysmography are discussed. It is shown that up to -2 kPa the extent of the volume shift depends on stratification. Higher muscle rigidity in extended legs decreases the volume shift into the interstitium, while there is no difference between -2 and -4 kPa in relaxed muscles. Above -4 kPa the influence of stratification on the extent of volume shift is decreased. Results are discussed on the basis of functional anatomy. ESA

**N88-23368#** Technische Hogeschool, Delft (Netherlands). Faculty of Aerospace Engineering.

### **MODELS DESCRIBING MUSCLE BEHAVIOR AND CONTROL**

M. M. VANPAASSEN Oct. 1987 77 p.  
(LR-522; B8733272; ETN-88-92464) Avail: NTIS HC A05/MF A01

Literature on models of (human) muscle control was surveyed. Three elements are distinguished in quantitative modelling of the muscle output function: the mechanical muscle output for a certain neural stimulation; the generation of this stimulation by the controlling neurons in the spinal cord, under the influence of signals from the central nervous system and feedback signals from the muscle receptors (tendon organ and muscle spindle); and generation of feedback signals by these muscle receptors. General models describing these three processes are only known for linear simulations. In these cases the parameters are fit to the observations in a specific task. Nonlinear models which, if accurate enough, could simulate the entire muscle behavior with a single set of parameters are not available. Especially concerning the processes in the spinal cord and the muscle spindle responses no accurate models are known. ESA

**N88-23369\*** National Aeronautics and Space Administration, Washington, D.C.

### **AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 310)**

May 1988 102 p  
(NASA-SP-7011(310); NAS 1.21:7011(310)) Avail: NTIS HC A06 CSCL 06E

This bibliography lists 305 reports, articles, and other documents

introduced into the NASA scientific and technical information system in April, 1988. Author

**N88-23378\*#** McDonnell-Douglas Astronautics Co., St. Louis, Mo. Human Performance Lab.

### **PUPIL MEASURES OF ALERTNESS AND MENTAL LOAD**

RICHARD W. BACKS and LARRY C. WALRATH In NASA. Langley Research Center, Mental-State Estimation, 1987 p 111-122 May 1988

Avail: NTIS HC A17/MF A01 CSCL 06S

A study of eight adults given active and passive search tasks showed that evoked pupillary response was sensitive to information processing demands. In particular, large pupillary diameter was observed in the active search condition where subjects were actively processing information relevant to task performance, as opposed to the passive search (control) condition where subjects passively viewed the displays. However, subjects may have simply been more aroused in the active search task. Of greater importance was that larger pupillary diameter, corresponding to longer search time, was observed for noncoded than for color-coded displays in active search. In the control condition, pupil diameter was larger with the color displays. The data indicate potential usefulness of pupillary responses in evaluating the information processing requirements of visual displays. J.P.B.

## 53

## BEHAVIORAL SCIENCES

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

**A88-37443\*** Massachusetts Inst. of Tech., Cambridge.

### **EFFECTS OF SCOPOLAMINE AND DEXTROAMPHETAMINE ON HUMAN PERFORMANCE**

JOHN F. SCHMEDTJE, JR., CHARLES M. OMAN, RICHARD LETZ, and EDWARD L. BAKER (MIT, Cambridge; Harvard University, Boston, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 407-410. refs (Contract NCC9-1)

The effects of two drugs used to prevent symptoms of motion sickness in the operational environment were examined in this study of human performance as measured by computer-based tests of cognitive and psychomotor skills. Each subject was exposed repetitively to five tests: symbol-digit substitution, simple reaction time, pattern recognition, digit span memory, and pattern memory. Although there have been previous reports of decreases in human performance in similar testing with higher dosages of scopolamine or dextroamphetamine, no significant decrements were observed with the operational-level combined dose used in this study (0.4 mg oral scopolamine and 5.0 mg oral dextroamphetamine.) The controversy over the use of combination drug therapy in this environment is discussed along with the indications for further research based on the findings. Author

**A88-37450**

### **PSYCHOSOCIAL TRAINING FOR PHYSICIANS ON BOARD THE SPACE STATION**

NICK KANAS (USVA, Medical Center, San Francisco, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, May 1988, p. 456, 457. refs

The training and specialty areas of the physicians who might be sent to the Space Station is discussed. It is argued that these candidates not only should be broadly trained to handle a number of acute physical problems and to conduct research on the effects of weightlessness on the human body physiology, but be also trained to handle various psychological and interpersonal problems related to long-term isolation and confinement. The knowledge areas that should be included in the psychological training of a space physician are outlined. I.S.

A88-37951#

**THE PSYCHOLOGY OF COMPUTER DISPLAYS IN THE MODERN MISSION CONTROL CENTER**

MICHAEL M. GRANAAS (South Dakota, University, Vermillion) IN: Aerodynamic Testing Conference, 15th, San Diego, CA, May 18-20, 1988, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 446-448. refs (AIAA PAPER 88-2065)

Work at NASA's Western Aeronautical Test Range (WATR) has demonstrated the need for increased consideration of psychological factors in the design of computer displays for the WATR mission control center. These factors include memory load, color perception, and cognitive processing abilities. A review of relevant work in the human factors psychology area is provided to demonstrate the need for this awareness. The information provided should be relevant in control room settings where computerized displays are being used. Author

A88-38686\*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**TRAINING FOR 21ST CENTURY SPACE MISSIONS**

FRANK E. HUGHES and ROBERT K. HOLKAN (NASA, Johnson Space Center, Houston, TX) NASA, AIAA, Lunar and Planetary Institute et al., Symposium on Lunar Bases and Space Activities in the 21st Century, Houston, TX, Apr. 5-7, 1988, Paper. 9 p.

Although specific recommendations are difficult to make about spacecraft and missions not yet designed, several general guidelines are presently formulated concerning the training of future, long-duration space mission crews. Training systems should be embedded in the normal controls and displays of the spacecraft used, so that critical maneuvers can be practiced as often as possible. Some system for computer-based training should be available onboard, in order to maintain the spacecraft system-knowledge of the crew at a high level and deepen understanding of malfunction responses. O.C.

A88-38716#

**PILOT WORKLOAD ASSESSMENT - A FLIGHT TEST APPROACH**

REGINA M. PAPA and JANICE R. STOLIKER (USAF, Flight Test Center, Edwards AFB, CA) IN: AIAA Flight Test Conference, 4th, San Diego, CA, May 18-20, 1988, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 133-142. refs (AIAA PAPER 88-2105)

The present methodology for the assessment of the pilot workload effects of integration between a fighter aircraft and a specialized sensor augmentation system, with a view to the question of single-seat cockpit effectiveness, allows the collection of subjective data pertinent to issues of cockpit controls and displays, situational awareness, task complexity, survivability, and safety. Two different subjective workload metrics (supplemented by structured interviews) are used: the subjective workload assessment technique, and a modified Cooper-Harper-type scale tailored for this application through the inclusion of a performance factor. O.C.

A88-39223

**SPATIO-TEMPORAL PARAMETERS AND THE THREE-DIMENSIONALITY OF APPARENT MOTION - EVIDENCE FOR TWO TYPES OF PROCESSING**

RICHARD D. WRIGHT, MICHAEL R. W. DAWSON, and ZENON W. PYLYSHYN (Western Ontario, University, London, Canada) Spatial Vision (ISSN 0169-1015), vol. 2, no. 4, 1987, p. 263-272. refs

(Contract NSERC-A-2600)

The minimum ISI required for perceiving apparent motion in depth was measured as a function of the two-dimensional separation of stimuli and the physical separation of stimuli in depth. It was found that temporal thresholds increased as a function of the separation of stimuli in depth. This supports the results of previous research indicating that the perceived three-dimensionality of apparent motion in depth increases with ISI. In addition, the

rate of threshold increase was significantly greater in displays with short two-dimensional separations of stimuli than in displays with large separations. This robust functional dissociation of thresholds indicates that the short-range system may be involved in the processing of apparent motion in depth in the former case.

Author

A88-39224

**THE GAUSSIAN DERIVATIVE MODEL FOR SPATIAL VISION. I - RETINAL MECHANISMS**

RICHARD A. YOUNG (GM Research Laboratories, Warren, MI) Spatial Vision (ISSN 0169-1015), vol. 2, no. 4, 1987, p. 273-293. refs

Physiological evidence is presented that visual receptive fields in the primate eye are shaped like the sum of a Gaussian function and its Laplacian. A new difference-of-offset-Gaussians (DOOG) neural mechanism was identified, which provided a plausible neural mechanism for generating such Gaussian derivativelike fields. The DOOG mechanism and the associated Gaussian derivative model provided a better approximation to the data than did the Gabor or other competing models. A model-free Wiener filter analysis provided independent confirmation of these results. A machine vision system was constructed to simulate human foveal retinal vision, based on Gaussian derivative filters. It provided edge and line enhancement (deblurring) and noise suppression, while retaining all the information in the original image. Author

A88-39225

**SOME TASK AND SIGNAL DEPENDENT RULES FOR SPATIAL VISION**

TERRY CAELLI (Alberta, University, Edmonton, Canada) and M. NAMIK OGUZTORELI (Muenchen, Universitaet, Munich, Federal Republic of Germany) Spatial Vision (ISSN 0169-1015), vol. 2, no. 4, 1987, p. 295-315. refs (Contract NSERC-A-2568; NSERC-A-4395)

The types of computational processes which may be involved in solving a variety of perceptual problems are considered, from the detection of signals in the presence of others, to texture discrimination, and some aspects of pattern recognition. These processes center around the involvement of correlational computations, the transduction of their input/output values, and the apparent involvement of selective filtering mechanisms. The results suggest that even if fixed detectors (in tuning characteristics) are involved in low-level vision, the human observer apparently employs much more adaptive (variable tuning characteristic) filters and nonlinear mechanisms in more complex spatial tasks.

Author

A88-39471\* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**DISCRETE ANALYSIS OF SPATIAL-SENSITIVITY MODELS**

KENNETH R. K. NIELSEN and BRIAN A. WANDELL (NASA, Ames Research Center, Moffett Field; Stanford University, CA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 5, May 1988, p. 743-755. refs (Contract NCC2-307; NIH-EY-03164)

Procedures for reducing the computational burden of current models of spatial vision are described, the simplifications being consistent with the prediction of the complete model. A method for using pattern-sensitivity measurements to estimate the initial linear transformation is also proposed which is based on the assumption that detection performance is monotonic with the vector length of the sensor responses. It is shown how contrast-threshold data can be used to estimate the linear transformation needed to characterize threshold performance. V.L.

A88-40060

**A COMPUTATIONAL THEORY FOR THE PERCEPTION OF COHERENT VISUAL MOTION**

ALAN L. YUILLE (Harvard University, Cambridge, MA) and NORBERTO M. GRZYWACZ (MIT, Cambridge, MA) Nature (ISSN 0028-0836), vol. 333, May 5, 1988, p. 71-74. Research supported

by the Alfred P. Sloan Foundation, Fairchild Foundation, U.S. Navy, and U.S. Army. refs

When we see motion, our perception of how one image feature moves depends on the behavior of other features nearby. Present theories of visual motion do not account fully for these coherent motion percepts. A theory is proposed here that does account for these phenomena and also provides a solution to the aperture problem, where the local information in the image flow is insufficient to specify the motion uniquely. C.D.

**A88-40521**

**AS LONG AS THERE WILL BE NAVIGATORS [TANT QUI'IL Y AURA DES NAVIGATEURS]**

M. ABRIC Navigation (Paris) (ISSN 0028-1530), vol. 36, April 1988, p. 233-237. In French.

The advantages and disadvantages of the presence of a second crew member, i.e., the navigator, for fulfilling the mission requirements of modern combat aircraft are considered, with emphasis on the impact of the navigator on flight safety. Modifications to convert five Nord 262Ds into navigator training vehicles are discussed. Flight tests have confirmed that the Nord 262 AEN meets the necessary specifications to provide training for aircraft including the Mirage 2000N, Mirage IV, and B.C-135.

R.R.

**A88-40985**

**THE PSYCHOLOGICAL HEALTH AND STRESS OF PILOTS IN A LABOR DISPUTE**

MICHEL GIRODO (Ottawa, University, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 505-510. refs

This study investigated the psychological stress and psychiatric symptomatology in a representative sample of pilots involved in a labor dispute with management. Standardized epidemiological psychometric instruments revealed that one quarter of the pilots could be labelled 'psychologically at risk' showing elevated symptoms of anger, hostility, paranoia, and obsessive compulsiveness. A certain combination of personality scores with stress reactions was found to correctly classify pilots who were healthy vs those at risk with 92 percent accuracy. Interviews with pilots revealed both general causes of stress associated with a labor dispute as well as specific and unique sources of disturbances threatening safety in the air. Author

**A88-40989**

**MOOD STATES AT 1600 AND 4300 METERS TERRESTRIAL ALTITUDE**

BARBARA L. SHUKITT and LOUIS E. BANDERET (U.S. Army, Army Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 530-532. refs

Personal anecdotes suggest that ascent to high altitude can cause mood changes such as depression, apathy, and drowsiness. Observed behaviors at high altitude indicate that people can become more euphoric, irritable, or argumentative. Since there are few systematic and quantitative studies assessing the effects of altitude on mood, this study compared moods measured at two different altitudes and times of day (morning-evening) using a standardized scale. Self-rated moods were determined twice daily in 19 males and 16 females with the Clyde Mood Scale. Baseline values were determined at 200 m; moods were then assessed at 4300 m with one group and at 1600 m with a second group. Friendliness, clear thinking, dizziness, sleepiness, and unhappiness were affected at 4300 m but only sleepiness changed at 1600 m. At 4300 m, the altered moods differed from baseline on the day of arrival (1-4 hours), differed even more after one day (18-28 hours), and returned to baseline by day 2 (42-52 hours). Morning and evening values were similar at each altitude. Therefore, changes in mood states at altitude have a distinct and measureable time course. Author

**A88-41362**

**VALIDATING VISUAL CUES IN FLIGHT SIMULATOR VISUAL DISPLAYS**

MOSES ARONSON (Aronson Industries, Orlando, FL) IN: Display system optics; Proceedings of the Meeting, Orlando, FL, May 21, 22, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 9-16. refs

Currently evaluations of visual simulators are performed by either pilot opinion questionnaires or comparison of aircraft terminal performance. The approach here is to compare pilot performance in the flight simulator with a visual display to his performance doing the same visual task in the aircraft as an indication that the visual cues are identical. The A-7 Night Carrier Landing task was selected. Performance measures which had high pilot performance prediction were used to compare two samples of existing pilot performance data to prove that the visual cues evoked the same performance. The performance of four pilots making 491 night landing approaches in an A-7 prototype part task trainer were compared with the performance of 3 pilots performing 27 A-7E carrier landing qualification approaches on the CV-60 aircraft carrier. The results show that the pilots' performances were similar, therefore concluding that the visual cues provided in the simulator were identical to those provided in the real world situation. Differences between the flight simulator's flight characteristics and the aircraft have less of an effect than the pilots individual performances. The measurement parameters used in the comparison can be used for validating the visual display for adequacy for training. Author

**A88-41363**

**EFFECTS OF TASK TRAINING AND INSTRUCTIONS ON FOVEAL LOAD**

EDWARD J. RINALDUCCI (Central Florida, University, Orlando) and PAUL N. ROSE (Georgia Institute of Technology, Atlanta) IN: Display system optics; Proceedings of the Meeting, Orlando, FL, May 21, 22, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 30-32. refs (Contract DAAL03-87-K-0014)

The goal of this research was to investigate the effects of foveal load on sensitivity in the peripheral visual field. Foveal load was manipulated by comparing the simple fixation of a cross vs. a first-order (i.e., rate) compensatory tracking task. Peripheral sensitivity was determined simultaneously for light flashes presented at different eccentricities along the horizontal meridian. The effects of training on the task were also evaluated in terms of changes in peripheral sensitivity. In general, the results showed no losses in peripheral sensitivity or a 'tunnel vision' effect under the experimental conditions employed. These results are contrary to data obtained by previous investigators. Reasons for these findings are discussed. Author

**N88-22533#** Massachusetts Univ., Amherst.

**ADAPTIVE NEURAL NETWORK ARCHITECTURE Final Report, 1 Aug. 1986 - 31 Jul. 1987**

ANDREW BARTO 28 Oct. 1987 4 p

(Contract AF-AFOSR-0260-86)

(AD-A190114; AFOSR-87-1789TR) Avail: NTIS HC A02/MF A01 CSCL 05I

Sun microsystems computer equipment acquired through Grant AFOSR-86-0260 is being used for research directed toward developing learning methods and architectures for artificial neural networks, or connectionist networks. The equipment is being used to simulate artificial neural networks implementing a variety of learning methods, including the Associative Reward-Penalty method and the Adaptive Critic Algorithm, as well as the error backpropagation method, and various combinations of these learning methods. GRA

**N88-22534#** Purdue Univ., West Lafayette, Ind. Dept. of Psychological Sciences.

**AUDITORY PATTERN MEMORY: MECHANISMS OF TONAL SEQUENCE DISCRIMINATION BY HUMAN OBSERVERS Final Report, 1 Sep. 1984 - 31 Aug. 1987**

ROBERT D. SORKIN 30 Sep. 1987 46 p  
(Contract AF AFOSR-0302-84)  
(AD-A190337; AFOSR-87-1775TR) Avail: NTIS HC A03/MF A01  
CSCL 12F

A two-process model of pattern discrimination was developed to describe how tonal sequences are processed, stored, and discriminated by the human auditory system. The model was tested in tasks in which subjects were required to discriminate between the frequency patterns encoded in two sequences of tones. The experimental results strongly supported the assumptions of a trace and context coding mechanism and indicated that the trace mechanism is relatively insensitive to temporal transformations made to the stimulus. An attempt to model the pattern discrimination mechanism with specific computational algorithms was less successful. A technique was developed to assess the manner in which information is accumulated from elements of an auditory or visual stimulus. Results indicate that the technique may be useful in the design of display systems. GRA

**N88-22535#** Aerospace Medical Research Labs.,  
Wright-Patterson AFB, Ohio.

**CONFLICT RESOLUTION IN COOPERATIVE SYSTEMS Final  
Report, Oct. 1985 - Oct. 1987**

DANIEL E. SNYDER and MICHAEL D. MCNEESE Oct. 1987  
93 p  
(AD-A190351; AD-E500947; AAMRL-TR-87-066) Avail: NTIS HC  
A05/MF A01 CSCL 12I

An integrated conflict resolution methodology is described in terms of its potential to reduce cognitive conflicts within cooperating human-intelligent systems environments. Three specific components of this methodology are presented. The first component, The Description/Depiction of Total Knowledge Concepts, explains a representational schema for depicting and isolating conflicting processes/states. The second component, Resolution Processes within Total Knowledge Concepts, proposes a baseline conflict resolver along with a review of theoretical positions regarding the processes of conflict resolution. This stage also describes the requirements for integrating human and non-human intelligent systems through the use of the human intelligence perspective. The result of this union is the creation of an intelligent architecture of resolution. The role of blackboard and processing models is outlined for such an architecture. The third component, Experimentation in Human Conflict Resolution, suggests direction that conflict resolution research must go to make significant contributions. The report's emphasis is on human cognitive analogs that provide examples for the modeling of conflict resolution processes. GRA

**N88-23370\*#** National Aeronautics and Space Administration,  
Langley Research Center, Hampton, Va.

**MENTAL-STATE ESTIMATION, 1987**

J. RAYMOND COMSTOCK, JR., comp. May 1988 393 p  
Workshop held in Williamsburg, Va., 3-4 Jun. 1987; sponsored by  
NASA, Langley Research Center, Hampton, Va. and Old Dominion  
Univ., Norfolk, Va. Sponsored by NASA, Washington  
(NASA-CP-2504; L-16420; NAS 1.55:2504) Avail: NTIS HC  
A17/MF A01 CSCL 05J

Reports on the measurement and evaluation of the physiological and mental state of operators are presented.

**N88-23371\*#** Advanced Resource Development Corp., Columbia,  
Md.

**AN OVERVIEW OF CURRENT APPROACHES AND FUTURE  
CHALLENGES IN PHYSIOLOGICAL MONITORING**

RICHARD L. HORST /n NASA, Langley Research Center,  
Mental-State Estimation, 1987 p 25-42 May 1988  
Avail: NTIS HC A17/MF A01 CSCL 05J

Sufficient evidence exists from laboratory studies to suggest that physiological measures can be useful as an adjunct to behavioral and subjective measures of human performance and capabilities. Thus it is reasonable to address the conceptual and engineering challenges that arise in applying this technology in operational settings. Issues reviewed include the advantages and

disadvantages of constructs such as mental states, the need for physiological measures of performance, areas of application for physiological measures in operational settings, which measures appear to be most useful, problem areas that arise in the use of these measures in operational settings, and directions for future development. Author

**N88-23373\*#** Maryland Univ., College Park.

**VAGAL TONE AS AN INDEX OF MENTAL STATE**

STEPHEN W. PORGES /n NASA, Langley Research Center,  
Mental-State Estimation, 1987 p 57-64 May 1988  
Avail: NTIS HC A17/MF A01 CSCL 05J

The utility of monitoring oscillations in the heart rate pattern as a window to the brain is discussed as an index of general central nervous system status. Quantification of the amplitude of respiratory sinus arrhythmia provides an accurate index of cardiac vagal tone. A number of studies have demonstrated the validity of this measure; the relationship between flight performance and vagal tone has also been studied. In general, the vagal tone index appears to monitor global states of the central nervous system and may be useful in screening the general state of pilots. J.P.B.

**N88-23374\*#** Naval Medical Research and Development  
Command, Bethesda, Md.

**CHALLENGES OF PHYSIOLOGICAL MONITORING IN A NAVY  
OPERATIONAL SETTING**

GUY R. BANTA /n NASA, Langley Research Center, Mental-State  
Estimation, 1987 p 65-79 May 1988  
Avail: NTIS HC A17/MF A01 CSCL 05J

Challenges to physiological monitoring in the Navy include environmental extremes, acceptance of use by test subjects, data transfer, data interpretation, and capability of relating collected data to valid operational relevant criterion measures. These problems are discussed with respect to diving, electrophysiological monitoring, in-flight monitoring, aircrew fatigue, in-flight cardiac stress, and in-flight monitoring devices. J.P.B.

**N88-23375\*#** Anacapa Sciences, Inc., Fort Rucker, Ala.

**PREDICTING OPERATOR WORKLOAD DURING SYSTEM  
DESIGN**

THEODORE B. ALDRICH and SANDRA M. SZABO /n NASA,  
Langley Research Center, Mental-State Estimation, 1987 p 81-96  
May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

A workload prediction methodology was developed in response to the need to measure workloads associated with operation of advanced aircraft. The application of the methodology will involve: (1) conducting mission/task analyses of critical mission segments and assigning estimates of workload for the sensory, cognitive, and psychomotor workload components of each task identified; (2) developing computer-based workload prediction models using the task analysis data; and (3) exercising the computer models to produce predictions of crew workload under varying automation and/or crew configurations. Critical issues include reliability and validity of workload predictors and selection of appropriate criterion measures. J.P.B.

**N88-23376\*#** Naval Safety Center, Norfolk, Va.

**CHRONIC STRESS AS A FACTOR IN AIRCRAFT MISHAPS**

ROBERT A. ALKOV /n NASA, Langley Research Center,  
Mental-State Estimation, 1987 p 99-105 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

Naval aviation is an unusually stressful career because of the inherent demands of the work. Stress is recognized as a cause of mishaps which involve pilot error. A questionnaire was adapted from Rahe and Homes' list of stressful life events in order to determine the relationship between pilot behavioral, personality, and life change factors on the one hand and responsibility for accidents on the other. A number of factors regarding interpersonal relationships, changes in personal behavior, personality factors, and life changes were found to discriminate between pilots who were and were not at fault in accidents. J.P.B.

**N88-23377\*#** Boeing Military Airplane Development, Wichita, Kans.

**ACUTE STRESS**

ROBERT P. BATEMAN /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 107-110 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

A number of case stories of aircraft accidents caused by pilot stress are related. J.P.B.

**N88-23379\*#** Washington Univ., St. Louis, Mo. Behavior Research Lab.

**PROBE-EVOKED EVENT-RELATED POTENTIAL TECHNIQUES FOR EVALUATING ASPECTS OF ATTENTION AND INFORMATION PROCESSING**

JOHN A. STERN /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 123-130 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

The study of probe event related potentials (probe ERPs) is reviewed. Several recent experiments are described which seem to leave in doubt the usefulness of applying ERP to simulation and field conditions as well as laboratory situations. Relatively minor changes in the experimental paradigm can produce major shifts in ERP findings, for reasons that are not clear. However, task-elicited ERPs might be used on a flight simulator if the experimenter takes time of arrival of the eyes on a particular instrument as one variable of concern and dwell time on the instrument as a second variable. One can then look at ERPs triggered by saccade termination for fixation pauses of specified durations. It may well be that ERP to a momentarily important display will differ from that elicited by routine instrument check.

J.P.B.

**N88-23380\*#** Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

**STEADY-STATE EVOKED POTENTIALS POSSIBILITIES FOR MENTAL-STATE ESTIMATION**

ANDREW M. JUNKER, JOHN H. SCHNURER, DAVID F. INGLE, and CRAIG W. DOWNEY /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 131-154 May 1988 Prepared in cooperation with Systems Research Labs., Inc., Dayton, Ohio

Avail: NTIS HC A17/MF A01 CSCL 05J

The use of the human steady-state evoked potential (SSEP) as a possible measure of mental-state estimation is explored. A method for evoking a visual response to a sum-of-ten sine waves is presented. This approach provides simultaneous multiple frequency measurements of the human EEG to the evoking stimulus in terms of describing functions (gain and phase) and remnant spectra. Ways in which these quantities vary with the addition of performance tasks (manual tracking, grammatical reasoning, and decision making) are presented. Models of the describing function measures can be formulated using systems engineering technology. Relationships between model parameters and performance scores during manual tracking are discussed. Problems of unresponsiveness and lack of repeatability of subject responses are addressed in terms of a need for loop closure of the SSEP. A technique to achieve loop closure using a lock-in amplifier approach is presented. Results of a study designed to test the effectiveness of using feedback to consciously connect humans to their evoked response are presented. Findings indicate that conscious control of EEG is possible. Implications of these results in terms of secondary tasks for mental-state estimation and brain actuated control are addressed. Author

**N88-23381\*#** New York Univ., New York.

**VOICE-STRESS MEASURE OF MENTAL WORKLOAD**

MURRAY ALPERT and SID J. SCHNEIDER (Behavioral Health Systems, Inc., Ossining, N.Y.) /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 155-162 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

In a planned experiment, male subjects between the age of 18 and 50 will be required to produce speech while performing various tasks. Analysis of the speech produced should reveal which aspects of voice prosody are associated with increased workloads.

Preliminary results with two female subjects suggest a possible trend for voice frequency and amplitude to be higher and the variance of the voice frequency to be lower in the high workload condition. J.P.B.

**N88-23382\*#** Advanced Resource Development Corp., Columbia, Md.

**PRIMARY TASK EVENT-RELATED POTENTIALS RELATED TO DIFFERENT ASPECTS OF INFORMATION PROCESSING**

ROBERT C. MUNSON, RICHARD L. HORST, and DAVID L. MAHAFFEY /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 163-178 May 1988

(Contract NAS1-17576; NAS1-18019)

Avail: NTIS HC A17/MF A01 CSCL 05J

The results of two studies which investigated the relationships between cognitive processing and components of transient event-related potentials (ERPs) are presented in a task in which mental workload was manipulated. The task involved the monitoring of an array of discrete readouts for values that went out of bounds, and was somewhat analogous to tasks performed in cockpits. The ERPs elicited by the changing readouts varied with the number of readouts being monitored, the number of monitored readouts that were close to going out of bounds, and whether or not the change took a monitored readout out of bounds. Moreover, different regions of the waveform differentially reflected these effects. The results confirm the sensitivity of scalp-recorded ERPs to the cognitive processes affected by mental workload and suggest the possibility of extracting useful ERP indices of primary task performance in a wide range of man-machine settings. Author

**N88-23383\*#** Battelle Memorial Inst., Seattle. Human Affairs Research Centers.

**DEFINING AND MEASURING PILOT MENTAL WORKLOAD**

BARRY H. KANTOWITZ /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 179-188 May 1988

(Contract NCC2-228)

Avail: NTIS HC A17/MF A01 CSCL 05J

A theory is sought that is general enough to help the researcher deal with a wide range of situations involving pilot mental stress. A limited capacity theory of attention forms the basis for the theory. Mental workload is then defined as an intervening variable, similar to attention, that modulates or indexes the tuning between the demands of the environment and the capacity of the organism. Two methods for measuring pilot mental workload are endorsed: (1) objective measures based on secondary tasks; and (2) psychophysiological measures, which have not yet been perfected but which will become more useful as theoretical models are refined. Secondary-task research is illustrated by simulator studies in which flying performance has been shown not to be adversely affected by adding a complex choice-reaction secondary task.

J.P.B.

**N88-23384\*#** Purdue Univ., West Lafayette, Ind.

**POPEYE: A PRODUCTION RULE-BASED MODEL OF MULTITASK SUPERVISORY CONTROL (POPCORN)**

JAMES T. TOWNSEND, HELENA KADLEC, and BARRY H. KANTOWITZ /in NASA. Langley Research Center, Mental-State Estimation, 1987 p 189-210 May 1988

(Contract NAG2-307)

Avail: NTIS HC A17/MF A01 CSCL 05J

Recent studies of relationships between subjective ratings of mental workload, performance, and human operator and task characteristics have indicated that these relationships are quite complex. In order to study the various relationships and place subjective mental workload within a theoretical framework, we developed a production system model for the performance component of the complex supervisory task called POPCORN. The production system model is represented by a hierarchical structure of goals and subgoals, and the information flow is controlled by a set of condition-action rules. The implementation of this production system, called POPEYE, generates computer simulated data under different task difficulty conditions which are comparable to those of human operators performing the task.

This model is the performance aspect of an overall dynamic psychological model which we are developing to examine and quantify relationships between performance and psychological aspects in a complex environment. Author

**N88-23385\*#** Purdue Univ., West Lafayette, Ind.  
**ESTIMATING THE COST OF MENTAL LOADING IN A BIMODAL DIVIDED-ATTENTION TASK: COMBINING REACTION TIME, HEART-RATE VARIABILITY AND SIGNAL-DETECTION THEORY**

PATRICIA A. CASPER and BARRY H. KANTOWITZ *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 211-229 May 1988

(Contract NCC2-228)

Avail: NTIS HC A17/MF A01 CSCL 05J

Multiple approaches are necessary for understanding and measuring workload. In particular, physiological systems identifiable by employing cardiac measures are related to cognitive systems. One issue of debate in measuring cardiac output is the grain of analysis used in recording and summarizing data. Various experiments are reviewed, the majority of which were directed at supporting or contradicting Lacey's intake-rejection hypothesis. Two of the experiments observed heart rate in operational environments and found virtually no changes associated with mental load. The major problems facing researchers using heart rate variability, or sinus arrhythmia, as a dependent measure have been associated with valid and sensitive scoring and preventing contamination of observed results by influences unrelated to cognition. Spectral analysis of heart rate variability offers two useful procedures: analysis from the time domain and analysis from the frequency domain. Most recently, data have been collected in a divided attention experiment, the performance measures and cardiac measures of which are detailed. J.P.B.

**N88-23386\*#** Purdue Univ., West Lafayette, Ind.

**SHORT-TERM MEMORY LOAD AND PRONUNCIATION RATE**  
 RICHARD SCHWEICKERT and CATHRIN HAYT *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 231-235 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

In a test of short-term memory recall, two subjects attempted to recall various lists. For unpracticed subjects, the time it took to read the list is a better predictor of immediate recall than the number of items on the list. For practiced subjects, the two predictors do about equally well. If the items that must be recalled are unfamiliar, it is advantageous to keep the items short to pronounce. On the other hand, if the same items will be encountered over and over again, it is advantageous to make them distinctive, even at the cost of adding to the number of syllables. J.P.B.

**N88-23387\*#** Massachusetts Univ., Worcester. Dept. of Neurology.

**ATTENTION, EFFORT, AND FATIGUE: NEUROPSYCHOLOGICAL PERSPECTIVES**

RONALD A. COHEN and BRIAN F. O'DONNELL *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 237-268 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05J

Models of attention, effort, and fatigue are reviewed. Methods are discussed for measuring these phenomena from a neuropsychological and psychophysiological perspective. The following methodologies are included: (1) the autonomic measurement of cognitive effort and quality of encoding; (2) serial assessment approaches to neurophysiological assessment; and (3) the assessment of subjective reports of fatigue using multidimensional ratings and their relationship to neurobehavioral measures. Author

**N88-23388\*#** Massachusetts Univ., Worcester. Dept. of Neurology.

**THE N2-P3 COMPLEX OF THE EVOKED POTENTIAL AND HUMAN PERFORMANCE**

BRIAN F. O'DONNELL and RONALD A. COHEN *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 269-286 May 1988 Sponsored in part by Alzheimer Disease Research Center; the Friedman Foundation; the Univ. of Mass. Medical Center Scientific Council; and the Sterling Morton Charitable Trust (Contract NIA-1-P50-OAG05134)

Avail: NTIS HC A17/MF A01 CSCL 05J

The N2-P3 complex and other endogenous components of human evoked potential provide a set of tools for the investigation of human perceptual and cognitive processes. These multidimensional measures of central nervous system bioelectrical activity respond to a variety of environmental and internal factors which have been experimentally characterized. Their application to the analysis of human performance in naturalistic task environments is just beginning. Converging evidence suggests that the N2-P3 complex reflects processes of stimulus evaluation, perceptual resource allocation, and decision making that proceed in parallel, rather than in series, with response generation. Utilization of these EP components may provide insights into the central nervous system mechanisms modulating task performance unavailable from behavioral measures alone. The sensitivity of the N2-P3 complex to neuropathology, psychopathology, and pharmacological manipulation suggests that these components might provide sensitive markers for the effects of environmental stressors on the human central nervous system. Author

**N88-23389\*#** State Univ. of New York, Binghamton. Dept. of Psychology.

**PROCESSING DEFICITS IN MONITORING ANALOG AND DIGITAL DISPLAYS: IMPLICATIONS FOR ATTENTIONAL THEORY AND MENTAL-STATE ESTIMATION RESEARCH**

DAVID G. PAYNE and VIRGINIA A. L. GUNTHER *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 287-311 May 1988

(Contract BRSG-S07RR07149-12)

Avail: NTIS HC A17/MF A01 CSCL 05J

Subjects performed short term memory tasks, involving both spatial and verbal components, and a visual monitoring task involving either analog or digital display formats. These two tasks (memory vs. monitoring) were performed both singly and in conjunction. Contrary to expectations derived from multiple resource theories of attentional processes, there was no evidence that when the two tasks involved the same cognitive codes (i.e., either both spatial or both verbal/linguistics) there was more of a dual task performance decrement than when the two tasks employed different cognitive codes/processes. These results are discussed in terms of their implications for theories of attentional processes and also for research in mental state estimation. Author

**N88-23390\*#** State Univ. of New York, Binghamton. Dept. of Psychology and Psychiatry.

**INFORMATION PROCESSING DEFICITS IN PSYCHIATRIC POPULATIONS: IMPLICATIONS FOR NORMAL WORKLOAD ASSESSMENT**

PHILIP D. HARVEY *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 313-323 May 1988

(Contract NIMH-MH38431)

Avail: NTIS HC A17/MF A01 CSCL 05J

In one study, schizophrenics, bipolar manics, and mentally normal individuals were administered a digit recall task. The total performance of schizophrenics looked much like that of a normal processor under a higher load level. The manics' performance was intermediate. Primary performance was particularly poor among the mentally ill subjects. In a second study, three groups in the same populations as in the first study were asked to shadow and recall verbatim eight descriptive text passages. Distraction effects were found for schizophrenics only in the areas of percentage of words correctly shadowed and recall variables; the two areas were not correlated, however. It appears that, for schizophrenics, distraction disrupts the ability to effectively shadow information to a greater extent than it disrupts the ability to encode information for recall. The two studies imply that capacity-carrying abnormalities

that affect the quantity but not the quality of information processing can be useful in pointing to information processing of normal humans under high load conditions. J.P.B.

**N88-23391\*# EEG Systems Lab., San Francisco, Calif.  
NEUROPHYSIOLOGICAL PREDICTORS OF QUALITY OF PERFORMANCE**

ALAN S. GEVINS *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 325-335 May 1988 Sponsored in part by AF; National Inst. of Neurological and Communicative Diseases and Strokes; and NSF  
Avail: NTIS HC A17/MF A01 CSCL 05J

New signal processing technologies have been developed to measure spatiotemporal neurocognitive processes of the human brain. In one experiment, application of these technologies produced measurements of distributed preparatory sets which predicted the accuracy of subsequent performance. In another experiment, neuroelectric changes were found in Air Force test pilots during the incipient stages of fatigue before behavior had severely degraded. Author

**N88-23392\*# Washington Univ., St. Louis, Mo. Behavior Research Lab.**

**PHYSIOLOGICAL MEASURES AND MENTAL-STATE ASSESSMENT**

JOHN A. STERN *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 337-344 May 1988  
Avail: NTIS HC A17/MF A01 CSCL 05J

General considerations regarding monitoring of operators for alertness are discussed, including who should be monitored and what information should be collected. Measures that have been used to ascertain more general and persistent states of alertness are outlined, including cardiac activity, peripheral vascular activity, skin conductance, electroencephalography, pupilligraphy, oculomotor activity, and body movements. J.P.B.

**N88-23393\*# NTI, Inc., Dayton, Ohio.**

**A CORRELATIONAL APPROACH TO PREDICTING OPERATOR STATUS**

CLARK A. SHINGLEDECKER *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 345-352 May 1988  
Avail: NTIS HC A17/MF A01 CSCL 05J

This paper discusses a research approach for identifying and validating candidate physiological and behavioral parameters which can be used to predict the performance capabilities of aircrew and other system operators. In this methodology, concurrent and advance correlations are computed between predictor values and criterion performance measures. Continuous performance and sleep loss are used as stressors to promote performance variation. Preliminary data are presented which suggest dependence of prediction capability on the resource allocation policy of the operator. Author

**N88-23394\*# Oklahoma Univ., Norman. Dept. of Psychology.  
BRAINSTEM RESPONSE AND STATE-TRAIT VARIABLES**

KIRBY GILLILAND *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 353-361 May 1988 Sponsored in part by NTI, Inc., Dayton, Ohio  
Avail: NTIS HC A17/MF A01 CSCL 05J

A series of investigations are summarized from a personality research program that have relevance for mental state estimation. Of particular concern are those personality variables that are believed to have either a biological or perceptual basis and their relationship to human task performance and psychophysiology. These variables are among the most robust personality measures and include such dimensions as extraversion-introversion, sensation seeking, and impulsiveness. These dimensions also have the most distinct link to performance and psychophysiology. Through the course of many of these investigations two issues have emerged repeatedly: these personality dimensions appear to mediate mental state, and mental state appears to influence measures of performance or psychophysiology. Author

**N88-23395\*# Veterans Administration Hospital, San Francisco, Calif. Speech Research Lab.**

**VOICE STRESS ANALYSIS**

MALCOLM BRENNER (National Transportation Safety Board, Washington, D. C.) and THOMAS SHIPP *In* NASA. Langley Research Center, Mental-State Estimation, 1987 p 363-376 May 1988 Sponsored by AF  
Avail: NTIS HC A17/MF A01 CSCL 05J

In a study of the validity of eight candidate voice measures (fundamental frequency, amplitude, speech rate, frequency jitter, amplitude shimmer, Psychological Stress Evaluator scores, energy distribution, and the derived measure of the above measures) for determining psychological stress, 17 males age 21 to 35 were subjected to a tracking task on a microcomputer CRT while parameters of vocal production as well as heart rate were measured. Findings confirm those of earlier studies that increases in fundamental frequency, amplitude, and speech rate are found in speakers involved in extreme levels of stress. In addition, it was found that the same changes appear to occur in a regular fashion within a more subtle level of stress that may be characteristic, for example, of routine flying situations. None of the individual speech measures performed as robustly as did heart rate. J.P.B.

**N88-23398# Illinois Univ., Urbana. Dept. of Psychology.  
THE DISPLAY OF MULTIVARIATE INFORMATION: THE EFFECTS OF AUTO- AND CROSS-CORRELATION, RELIABILITY AND HETEROGENEITY Interim Report, Sep. 1985 - Sep. 1986**

PATRICIA M. JONES and CHRISTOPHER D. WICKENS Dec. 1987 22 p

(Contract MDA903-83-K-0255; DA PROJ. 2Q1-61102-B-74) (AD-A191070) Avail: NTIS HC A03/MF A01 CSCL 12C

Process control systems typically involve many variables that can be intercorrelated with each other (cross-correlated), correlated with themselves over time (auto-correlated), and that are represented by displays possessing varying degrees of reliability. These factors are examined in an information integration task which compares the relative advantages of integral and separable displays (pentagons and staggered bargraphs). The degree of cross-correlation between the cues and the heterogeneity of cue reliability (equal or differing values between the cues) was varied factorially between subjects; the input dynamics (auto-correlated or random over time) and display (pentagon or bargraph) were varied factorially within subjects. Results indicated an advantage for cross-correlated information and for the integral display given uncorrelated information. The results are interpreted within the framework proposed by Wickens and his colleagues of the display proximity advantage. GRA

**N88-23399# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.**

**PROBLEM SOLVING IN A NATURAL TASK AS A FUNCTION OF EXPERIENCE Interim Report, Jul. 1986 - Jul. 1987**

JULIANA S. LANCASTER and JANET L. KOLODNER Dec. 1987 14 p

(Contract MDA903-86-C-0173; DA PROJ. 2Q1-61102-B-74-F) (AD-A191180; ARI-RN-87-71) Avail: NTIS HC A03/MF A01 CSCL 05H

The effects of experience on problem solving behavior and the knowledge base of workers is investigated in an applied setting, i.e., automobile mechanics. The automobile is a highly complex system with many interconnected subsystems. Problem descriptions presented to a mechanic who needs to diagnose a car are usually sketchy, however. Novices are less able than experts to diagnose any but the most obvious problems. This research note concerns itself with identifying the qualitative differences between mechanics with different levels of expertise. Three student mechanics are observed in a post-secondary technical school, each at a different level of expertise, diagnosing six problems introduced into cars in the school. Collected protocols are then analyzed to find the knowledge and strategies used in solving each problem. Series of protocols for each student were

also analyzed to find the changes in knowledge and strategies used in solving later problems as compared to earlier problems. Differences were seen in both the knowledge used by the subjects and their general approach to diagnosis. Based on experience, the student mechanics seemed to improve in three areas: (1) their knowledge of the relationships between symptoms and possible failures was augmented; (2) their causal models of the car's systems were augmented; and (3) their general troubleshooting procedures and decision rules were much improved. GRA

**N88-23400#** Illinois Univ., Champaign. Cognitive Psychophysiology Lab.

**THE EVENT-RELATED BRAIN POTENTIAL AS AN INDEX OF INFORMATION PROCESSING AND COGNITIVE ACTIVITY: A PROGRAM OF BASIC RESEARCH Final Technical Report, 1**

Jan. - 31 Dec. 1987

EMANUEL DONCHIN, MICHAEL COLES, and ARTHUR KRAMER  
29 Feb. 1988 917 p

(Contract F49620-85-C-0041)

(AD-A191244; CPL-88-1; AFOSR-88-0316TR) Avail: NTIS HC A99/MF E03 CSCL 05H

This report describes research conducted in Cognitive Psychophysiology. Our primary mission has been to develop an understanding of the Event-Related Brain Potential (ERP) so that it can be used in the study of human cognitive function and in the assessment of man-machine interactions. To this end, we have conducted research in the following areas: the use of ERPs in the study of attention and skill acquisition; the use of ERPs in the study of mental chronometry; the use of ERPs in the study of mental resources and workload; the use of ERPs in the study of memory; the development of animal model of the P300 component; and the use of ERPs as a communication channel. Listed are all chapters, papers, abstracts and presentations that were published, submitted, or in preparation in 1987. GRA

**N88-23401#** Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

**EXTENDING PROBLEM SOLVER CAPABILITIES THROUGH CASE-BASED INFERENCE Interim Report, Jul. 1986 - Jun. 1987**

JANET L. KOLODNER Dec. 1987 11 p

(Contract MDA903-86-C-0173; DA PROJ. 2Q1-61102-B-74-F)

(AD-A191332; ARI-RN-87-82) Avail: NTIS HC A03/MF A01 CSCL 05H

This document reviews work done on case-based reasoning. In this sort of reasoning, the problem solver makes inferences based directly on previous cases rather than using the more traditional method of reliance on general knowledge. Case-based reasoning results in several enhancements to problem-solving behavior over time. First, recall of previous failures warns the problem solver of the potential for failure, and allows it to avoid the repetition of past mistakes. Second, the previous decisions that have been made are suggested to the problem solver so that its decisions do not all have to be made starting from scratch. This lessons the search space, and also serves as a way of shortcutting the constraint satisfaction process. Third, if abstract schemata can be derived from cases that have been seen previously, generalized knowledge can be augmented. This allows real shortcuts in problem solving. Decisions that previously took several steps in reasoning to make may become easier through the application of a generalized schema. GRA

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**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

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

**A88-38183#**

**EFFECT OF +G STRESS AT DIFFERENT SEAT BACK ANGLES ON HUMAN OPERATOR TRACKING PERFORMANCE**

BAOSHENG XIE, ZHANGNIAN QI, ZHENYONG XU, and GUANYUAN LIU (Institute of Space Medico-Engineering, Beijing, People's Republic of China) Acta Aeronautica et Astronautica Sinica (ISSN 1000-6893), vol. 9, Jan. 1988, p. A69-A74. In Chinese, with abstract in English. refs

Five young male subjects wearing an anti-G suit were exposed to +G stress at four setback angles and were tested for tracking performance on a human centrifuge of six meter radius. Physical parameters, tracking error, output signal of the side-arm controller, and physiological parameters were recorded. The results showed that the subjects' mean tracking error and psychophysiological load increased with increasing G value and decreasing setback angles. The subjects' tracking performance was improved by inflating the anti-G suits at G levels 0.3 G lower than the levels at which peripheral vision loss occurred. Tracking performance was best at 60 deg setback angle. A method for evaluating human working ability and the cause of changes in human operator tracking performance under +G stress is analyzed and discussed. C.D.

**A88-38685\*#** Bionetics Corp., Hampton, Va.

**THE ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM FOR A LUNAR BASE - WHAT DRIVES ITS DESIGN**

WARREN D. HYPES (Bionetics Corp., Hampton, VA) and JOHN B. HALL, JR. (NASA, Langley Research Center, Hampton, VA) NASA, AIAA, Lunar and Planetary Institute et al., Symposium on Lunar Bases and Space Activities in the 21st Century, Houston, TX, Apr. 5-7, 1988, Paper. 22 p.

It is noted that no single ECLSS is uniquely applicable to a mission of given crew size and duration; all mission parameters, together with details of other systems, must accordingly be factored into the lunar base ECLSS design process that is presently discussed. Experience to date with ECLSS design tasks indicates that mission planners and systems engineers should refrain from emphasizing the 'closed loop' aspects of such systems, since even the best regenerative processes will involve expendable materials that must be resupplied; resupply logistics will accordingly constitute a considerable effort of lunar base operation. Technology development status for processes and subsystems is identified as a major ECLSS design driver. O.C.

**A88-40371#**

**TRIAL MANUFACTURE OF BIOFEEDBACK TRAINING SYSTEM**

TOSHIRO TACHIBANA, SHIDO NISHIOKA, TETSURO HAMADA, KOUHEI HARADA, and KAZUYOSHI HIRAKAWA Kyushu University, Technology Reports (ISSN 0023-2718), vol. 60, Dec. 1987, p. 751-755. In Japanese, with abstract in English. refs

Many studies on the biofeedback reported that skin temperature, electroencephalogram, heart rate, blood pressure, etc., could be controlled and that clinical effect could be expected by biofeedback training. But its mechanism has not been clarified. On the basis of the biofeedback of skin temperature a biofeedback training system has been developed which is controlled by a personal computer. The usefulness of this system is confirmed. Author

**A88-40493\*** Georgia Inst. of Tech., Atlanta.

**ON THE DESIGN OF MAN-MACHINE SYSTEMS - PRINCIPLES, PRACTICES AND PROSPECTS**

WILLIAM B. ROUSE (Search Technology, Inc.; Georgia Institute of Technology, Atlanta) and WILLIAM J. CODY (Search

Technology, Inc., Atlanta, GA) Automatica (ISSN 0005-1098), vol. 24, March 1988, p. 227-238. refs  
(Contract F33615-86-C-0542; F33615-84-C-0500; NAS1-17874)

A large proportion of the problems associated with complex systems have been attributed, at least in part, to the human operators, maintenance personnel, or managers who work within these systems. It appears, therefore, that improving man-machine system design may contribute to decreasing substantially the frequency of problems in complex systems. In this paper, alternative views of how the design of man-machine systems might be improved are described and contrasted. A two-part approach for achieving the desired improvements is proposed. Author

**A88-40525**  
**CANADARM COMPUTER SIMULATION FACILITY AT SPAR AEROSPACE**

PETER JEDICKE and CLIFFORD CUNNINGHAM Spaceflight (ISSN 0038-6340), vol. 30, June 1988, p. 244-247.

Simulation facilities for the Canadarm Shuttle Remote Manipulator System (RMS) are discussed. The Canadarm can handle payloads of up to 30,000 kg and sizes of 4.5 m X 18 m. The simulator software, named ASAD, incorporates up to 30 selectable flexible modes and is made up of five basic modules: arm dynamics; joint servo and gear box; arm control algorithm; orbiter attitude control system; and display. The Canadian Simulator FACility (SIMFAC) consists of a master control, the operator complex, simulation system and the scene generation system. Development of simulator capability will continue with the Manipulator Dynamics Simulator Facility (MDSF), combining ASAD and SIMFAC. MDSF will be at least ten times faster than ASAD and will be able to interface with real hardware. New remote manipulator arms are being developed which will be part of the Mobile Service Structure, which will be Canada's contribution to the international space station. R.B.

**A88-40715#**  
**AERODYNAMIC FORCES ON FLIGHT CREW HELMETS**

TIMOTHY A. SESTAK (U.S. Navy, Naval Air Development Center, Warminster, PA), RICHARD M. HOWARD, and CHESTER A. HEARD (U.S. Naval Postgraduate School, Monterey, CA) IN: AIAA Applied Aerodynamics Conference, 6th, Williamsburg, VA, June 6-8, 1988, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 138-146. refs (AIAA PAPER 88-2525)

Wind tunnel tests were conducted to determine the aerodynamic forces generated on aircrew flight helmets. Three helmets were tested: two used by aircrews flying ejection seat aircraft in the U.S. military, the Navy HGU-33/P and the Air Force HGU-53/P; and one prototype helmet of significantly different shape and volume. Axial and normal forces were measured through a range of pitch and yaw angles. It was found that large forces exist tending to promote helmet loss during ejection, and that simple modifications to the current helmet configurations can reduce those forces by as much as 40 percent. It is demonstrated that the proper design of future helmet external geometry can contribute to the increased safety and survivability of aircrews in the ejection environment. Author

**A88-40994**  
**A HUMAN-USE CENTRIFUGE FOR SPACE STATIONS - PROPOSED GROUND-BASED STUDIES**

RUSSELL R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, June 1988, p. 579-582. refs

This paper discusses the possibility of using human centrifuges in space as means of providing artificial gravity and thus avoiding the effects of prolonged exposures to weightlessness. On the basis of the results of Piemme, et al. (1966) and Schneider (1987), obtained in ground studies on the effect of G levels on the control of fluid volume and bone loss, respectively, it is considered that high-G exposure of several minutes to several hours per day will be sufficient to provide adequate countermeasure, because for many physiological parameters, the necessary G requirements may

have a time-intensity summation effect. It is emphasized that on-ground studies should involve exposures greater than 1 G.

I.S.

**A88-41365\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**COCKPIT READINESS FOR NIGHT VISION GOGGLES**

MARIJA S. SCHOLL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and JAMES W. SCHOLL (Alenka Associates, Tempe, AZ) IN: Display system optics; Proceedings of the Meeting, Orlando, FL, May 21, 22, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 54-60. refs

The introduction of night vision goggles into the cockpit environment may produce incompatibility with existing cockpit optoelectronic instrumentation. The methodology used to identify the origin of the spurious signal is demonstrated with the example of an electronic display. The amount of radiation emitted by a gray body in the wavelength region of goggle sensitivity is calculated. A simple procedure for preflight testing of cockpit instrumentation using a commercially available infrared camera is recommended. Other recommendations include the specification of cockpit instrumentation for compatibility with night vision devices. Author

**N88-22536#** Transportation Systems Center, Cambridge, Mass.  
**ANALYSIS OF HEAD RESPONSE TO TORSO ACCELERATION. VOLUME 2: DESCRIPTION OF DATA RETRIEVAL, ANALYSIS AND DISPLAY SOFTWARE Final Report, Dec. 1982 - Jul. 1986**  
C. H. SPENNY Dec. 1987 152 p Sponsored by National Highway Traffic Safety Administration, Washington, D.C.  
(PB88-156765; DOT-TSC-NHTSA-86-6-VOL-2; DOT-HS-807-158-VOL-2) Avail: NTIS HC A08/MF A01 C SCL 05H

The data retrieval, analysis and display software described here consists of a general purpose data manipulation program, the Data Retrieval and Display (DRD) program, and a pair of specialized analysis programs, HEAD and NECK. The DRD program is user friendly and is designed to quickly and efficiently retrieve and graphically display data on head and neck response. HEAD and NECK are programs written for use in the analysis of head and neck response. Author

**N88-22537#** Applied Technologies, Inc., Boulder, Colo.  
**ULTRASONIC OXYGEN SENSOR Final Report, May 1986 - Aug. 1987**

W. R. DAGLE Dec. 1987 28 p  
(Contract F33615-86-C-4503)  
(AD-A189723; USAFSAM-TR-87-31) Avail: NTIS HC A03/MF A01 C SCL 14B

The respirable gases generated by an on board oxygen generation system (OBOGS) are comprised of a mixture of oxygen, argon, and nitrogen. This gas mixture can be measured ultrasonically to determine the concentration of oxygen within the mixture. This final report describes an ultrasonic measurement system that has been successfully tested to a simulated altitude of 20,000 ft. The concentration of oxygen calculated from ultrasonic data is accurate to approximately 1 percent over the range of 21 to 95 percent. In addition to measuring the concentration of oxygen, the ultrasonic oxygen sensor can also measure the flow rate of the respirable gases produced by an OBOGS accurate to approximately 1.6 L/min. GRA

**N88-22538#** Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.

**AN EVALUATION OF THE EFFECTS OF HIGH VISUAL TASKLOAD ON THE SEPARATE BEHAVIORS INVOLVED IN COMPLEX MONITORING PERFORMANCE**

RICHARD I. THACKRAY and R. M. TOUCHSTONE Jan. 1988 16 p  
(AD-A190641; DOT/FAA/AM-88/1) Avail: NTIS HC A03/MF A01 C SCL 05H

Operational monitoring situations, in contrast to typical

laboratory vigilance tasks, generally involve more than just stimulus detection and recognition. They frequently involve complex multidimensional discriminations, interpretations of significance, decisions as to appropriate action, implementation of action, and evaluation of consequences. A simulated air traffic control (ATC) task was developed to study the effects of prolonged monitoring on a number of such behaviors. All subjects performed the task under relatively high visual taskload conditions for a single 120-min session. Time to detect aircraft at the same altitude increased significantly over the monitoring period as did omission errors for this type of event. Detection time for the more readily detectible alphanumeric changes involving loss of altitude information showed no evidence of impairment, nor was any impairment found for any of the other task behaviors that were measured. The findings are discussed with reference to previous studies suggesting that complex monitoring primarily effects attentional processes and that the rate of decline in attention appears to be related to the degree of information processing required for event detection. GRA

**N88-22539#** Air Force Human Resources Lab., Brooks AFB, Tex.

**RELATIONSHIP OF ENCODING SPEED AND MEMORY TESTS TO FLIGHT TRAINING PERFORMANCE Interim Report, Sep. 1983 - Dec. 1986**

THOMAS R. CARRETTA Mar. 1988 24 p  
(AD-A190670; AFHRL-TP-87-49) Avail: NTIS HC A03/MF A01 CSCL 05H

The demands on the cognitive/perceptual abilities of military pilots have increased steadily as aircraft have become more sophisticated. The ability to encode and classify signals and to retrieve information from short-term memory are two of the several cognitive/perceptual abilities that have been linked to flying performance. Two tests, Encoding Speed (encoding and classification ability) and Immediate/Delayed Memory (short-term memory retrieval), were administered to 2,219 United States Air Force pilot candidates prior to entry into Undergraduate Pilot Training (UPT). Performance on the Encoding Speed test was related to successful completion of UPT, in-flight performance measures, and advanced training assignment. However, scores on the Immediate/Delayed memory test were not related to training performance. Pilot candidates who made quick or accurate responses on the Encoding Speed test were more likely to perform well on in-flight performance measures and be recommended for post-UPT training in a fast-jet (Fighter-Attack-Reconnaissance) aircraft. Implications for pilot selection and classification are discussed. GRA

**N88-22540\*#** Stanford Univ., Calif. Center for Design Research.

**DESIGN, DEVELOPMENT AND EVALUATION OF STANFORD/AMES EVA PREHENSORS Final Report**

LARRY J. LEIFER, J. ALDRICH, M. LEBLANC, E. SABELMAN, and D. SCHWANDT May 1988 10 p  
(Contract NCC2-295)  
(NASA-CR-182688; NAS 1.26:182688) Avail: NTIS HC A02/MF A01 CSCL 05H

Space Station operations and maintenance are expected to make unprecedented demands on astronaut EVA. With Space Station expected to operate with an 8 to 10 psi atmosphere (4 psi for Shuttle operations), the effectiveness of pressurized gloves is called into doubt at the same time that EVA activity levels are to be increased. To address the need for more frequent and complex EVA missions and also to extend the dexterity, duration, and safety of EVA astronauts, NASA Ames and Stanford University have an ongoing cooperative agreement to explore and compare alternatives. This is the final Stanford/Ames report on manually powered Prehensors, each of which consists of a shroud forming a pressure enclosure around the astronaut's hand, and a linkage system to transfer the motions and forces of the hand to mechanical digits attached to the shroud. All prehensors are intended for attachment to a standard wrist coupling, as found on the AX-5 hard suit prototype, so that realistic tests can be performed under

normal and reduced gravity as simulated by water flotation.

Author

**N88-23372\*#** GMS Engineering Corp., Columbia, Md.

**TOWARD A MATHEMATICAL FORMALISM OF PERFORMANCE, TASK DIFFICULTY, AND ACTIVATION**

GEORGE M. SAMARAS /n NASA. Langley Research Center, Mental-State Estimation, 1987 p 43-55 May 1988 Prepared in cooperation with Advanced Resource Development Corp., Columbia, Md.

(Contract DAMD17-86-C-6027)

Avail: NTIS HC A17/MF A01 CSCL 05H

The rudiments of a mathematical formalism for handling operational, physiological, and psychological concepts are developed for use by the man-machine system design engineer. The formalism provides a framework for developing a structured, systematic approach to the interface design problem, using existing mathematical tools, and simplifying the problem of telling a machine how to measure and use performance. Author

**N88-23396\*#** School of Aerospace Medicine, Brooks AFB, Tex.  
**DEVELOPMENT OF A C3 GENERIC WORKSTATION: SYSTEM OVERVIEW**

DAVID R. STROME /n NASA. Langley Research Center, Mental-State Estimation, 1987 p 377-380 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05H

A command, control, and communications (C3) environment is described which will be applied to the evaluation of performance of aircrews, particularly in situations in which they are subjected to chemical defense protection drugs and antihistamines. J.P.B.

**N88-23397\*#** NTI, Inc., San Antonio, Tex.

**C3 GENERIC WORKSTATION: PERFORMANCE METRICS AND APPLICATIONS**

DOUGLAS R. EDDY /n NASA. Langley Research Center, Mental-State Estimation, 1987 p 381-384 May 1988

Avail: NTIS HC A17/MF A01 CSCL 05H

The large number of integrated dependent measures available on a command, control, and communications (C3) generic workstation under development are described. In this system, embedded communications tasks will manipulate workload to assess the effects of performance-enhancing drugs (sleep aids and decongestants), work/rest cycles, biocybernetics, and decision support systems on performance. Task performance accuracy and latency will be event coded for correlation with other measures of voice stress and physiological functioning. Sessions will be videotaped to score non-verbal communications. Physiological recordings include spectral analysis of EEG, ECG, vagal tone, and EOG. Subjective measurements include SWAT, fatigue, POMS and specialized self-report scales. The system will be used primarily to evaluate the effects on performance of drugs, work/rest cycles, and biocybernetic concepts. Performance assessment algorithms will also be developed, including those used with small teams. This system provides a tool for integrating and synchronizing behavioral and psychophysiological measures in a complex decision-making environment. Author

**N88-23402#** Technische Hogeschool, Delft (Netherlands). Faculty of Aerospace Engineering.

**THE BIOMORPHIC MODEL OF THE HUMAN OPERATOR CONTROLLING A SINGLE OR A DOUBLE INTEGRATOR**

O. H. GERLACH Dec. 1987 133 p

(LR-505; B8733282; ETN-88-92454) Avail: NTIS HC A07/MF A01

A mathematical model of the overt behavior of a human operator, when controlling a single integrator or a double integrator in a closed loop compensatory tracking task, is discussed. The aim is to achieve a close correspondence between the physiological and psychological processes going on in the actual human controller and their mathematical simulation in the model, hence the latter is named the biomorphic model. In its initial and relatively simple version, the biomorphic model refers only to single-display, single-axis control situations. A mathematical description of the

underlying psychophysical processes is given. A computer program for adjusting the free parameters in the model and calculating the latter's characteristics is presented. Quantitative applications are given and the results are compared with results from the literature. ESA

**N88-23403#** Illinois Univ., Urbana. Dept. of Psychology.  
**THE REPRESENTATIONAL CODE OF THE INTERNAL MODEL OF DYNAMIC SYSTEMS: AN INDIVIDUAL DIFFERENCES AND DUAL TASK APPROACH** Interim Report  
CHRISTOPHER D. WICKENS and ANNETTE WEINGARTNER  
Dec. 1987 40 p  
(Contract MDA903-83-K-0255; DA PROJ. 2Q1-61102-B-74-F)  
(AD-A190876; ARI-RN-87-78) Avail: NTIS HC A03/MF A01  
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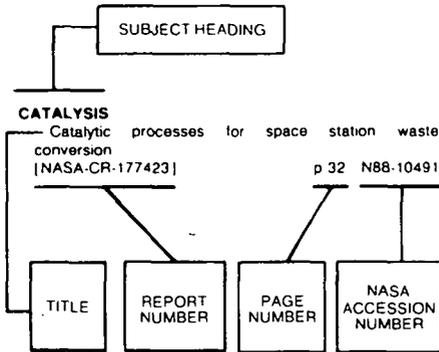
When a human operator monitors and controls complex dynamic processes, it is assumed that an internal representation of the process directs the operator's actions. This internal model is presumed to lie at some point along a verbal-spatial continuum. In order to determine the point on this continuum, nine subjects with high verbal and low spatial abilities, and nine with low verbal and high spatial abilities performed a multi-element failure detection task, either by itself, or concurrently with either a verbal or spatial secondary memory task. Patterns of interference between the maintaining and updating of the internal model and the performing of the memory tasks were used to infer the mode of internal model employed by the subjects. Interference results confirm that the failure detection task is spatial, and, as expected, verbal subjects performed better on the verbal secondary task and spatial subjects performed better on the spatial one. Both ability groups demonstrated similar failure detection abilities, and generated similar patterns of dual task interference. These results indicated that all subjects adopted the same strategy for failure detection.

GRA

**N88-23404#** Dayton Univ., Ohio. Research Inst.  
**TASK LISTING: VISUALLY ASSISTED AND VISUALLY DEPENDENT TASKS FOR FIGHTER AIRCRAFT** Final  
Technical Report, Dec. 1986 - Aug. 1987  
HAROLD D. WARNER Apr. 1988 24 p  
(Contract F33615-84-C-0066)  
(AD-A191041; AFHRL-TP-87-55) Avail: NTIS HC A03/MF A01  
CSCL 05I

A comprehensive listing of visually dependent and visually assisted flight tasks in Air Force fighter and attack aircraft training was developed. Additionally, the list specifies whether the tasks are trained exclusively in daylight or also at night. The individual visual tasks are provided for 11 major areas of training: (1) takeoff and landing, (2) aerobatics, (3) aircraft handling maneuvers, (4) stalls, (5) basic formation, (6) navigation, (7) air refueling, (8) tactical formation, (9) air-to-air combat, (10) low-altitude maneuvers, and (11) surface attack. Practical applications of the task listing in aviation research and development are discussed. GRA

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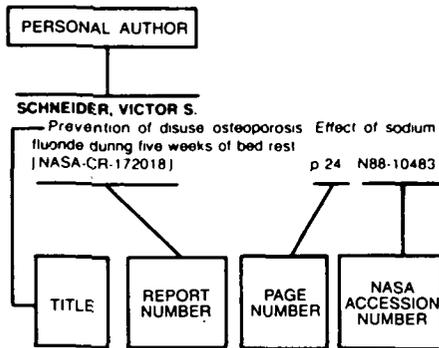
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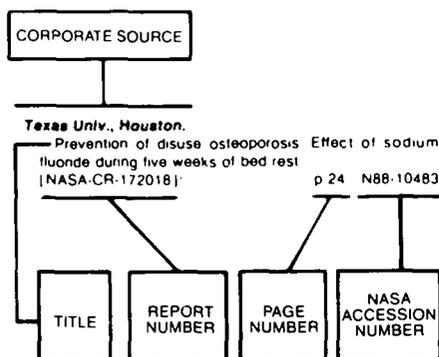
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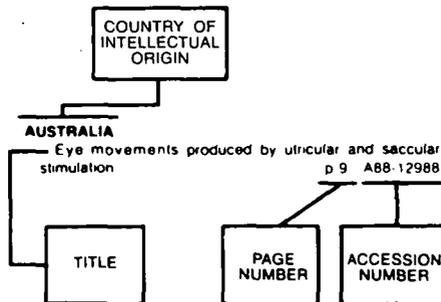
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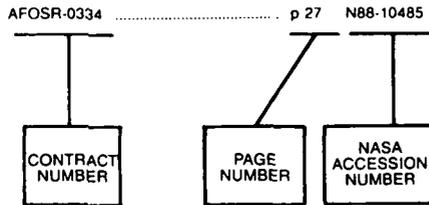
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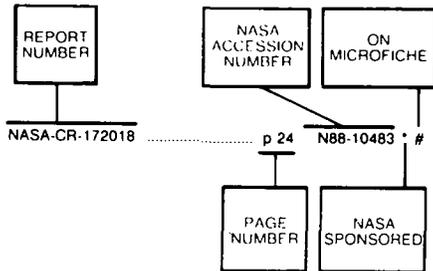
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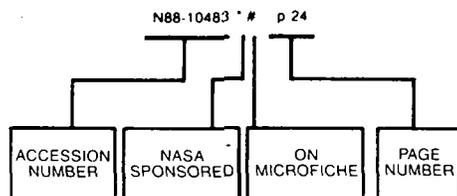


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