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A Continuing Bibliography with Indexes

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 317)

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 November 1988 in

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

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 182 reports, articles and other documents announced during November 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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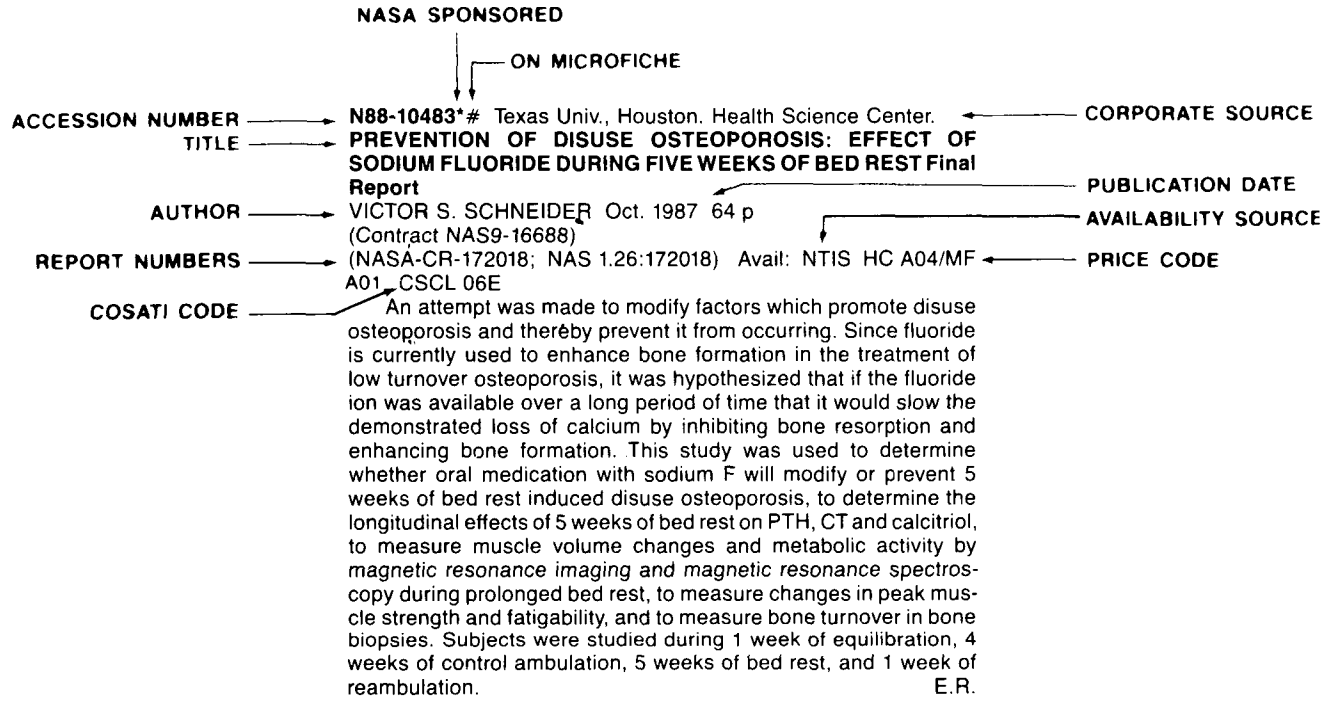
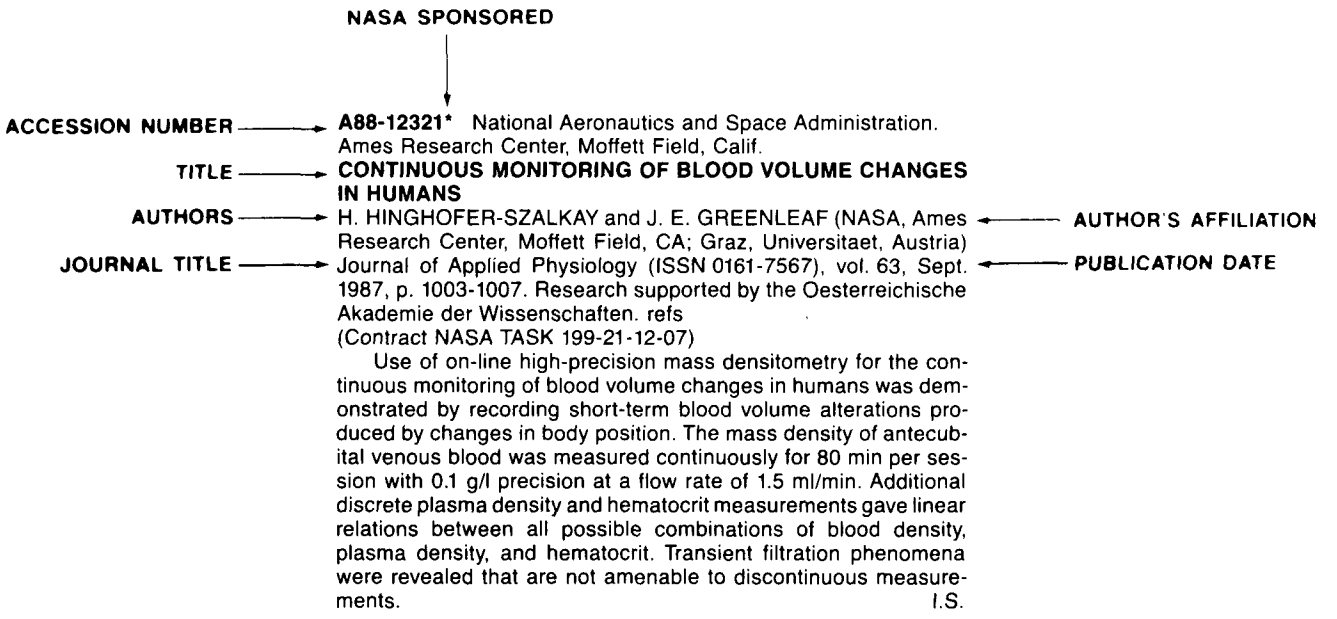
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 317)

DECEMBER 1988

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LIFE SCIENCES (GENERAL)

A88-49390* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CELL SEPARATION BY IMMUNOAFFINITY PARTITIONING WITH POLYETHYLENE GLYCOL-MODIFIED PROTEIN A IN AQUEOUS POLYMER TWO-PHASE SYSTEMS
LAUREL J. KARR, JAMES M. VAN ALSTINE, ROBERT S. SNYDER (NASA, Marshall Space Flight Center, Huntsville, AL), STEVEN G. SHAFER, and J. MILTON HARRIS (Alabama, University, Huntsville) Journal of Chromatography (ISSN 0021-9673), vol. 442, 1988, p. 219-227. Research supported by the Universities Space Research Association. refs

Previous work has shown that polyethylene glycol (PEG)-bound antibodies can be used as affinity ligands in PEG-dextran two-phase systems to provide selective partitioning of cells to the PEG-rich phase. In the present work it is shown that immunoaffinity partitioning can be simplified by use of PEG-modified Protein A which complexes with unmodified antibody and cells and shifts their partitioning into the PEG-rich phase, thus eliminating the need to prepare a PEG-modified antibody for each cell type. In addition, the paper provides a more rigorous test of the original technique with PEG-bound antibodies by showing that it is effective at shifting the partitioning of either cell type of a mixture of two cell populations. Author

A88-49783
EFFECTS OF LISURIDE AND QUINPIROLE ON CONVULSIONS INDUCED BY HYPERBARIC OXYGEN IN THE MOUSE
C.-O. CRIBORN, A. MUREN, S. AHLENIUS, and V. HILLEGAART (Forsvarets Forskningsanstalt, Stockholm; Astra Alab, AB, Research and Development, Sodertalje, Sweden) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 723-727. refs

Two ergot derivatives, lisuride and quinpirole, were examined for their ability to antagonize hyperbaric oxygen-induced (5 ATA O2) convulsions in mice. Significant protection was obtained, and the efficacy was found to be about 50 percent of the protection obtained by diazepam. Both lisuride and quinpirole significantly reduced rectal temperature at all doses administered. In separate experiments, at normal atmospheric conditions, all drugs to some extent reduced estimated respiratory minute volume. Taking these effects into account, lisuride is considerably more active as an anticonvulsant than quinpirole. Author

A88-50637
ROLE OF THE SPLEEN IN THE REGULATION OF THE 11-OXYCORTICOSTEROID AND BIOGENIC AMINE CONTENTS IN BLOOD PLASMA OF RATS DURING STRESS [ROL' SELEZENKI V REGULIATSII SODERZHANIIA 11-OKSIKORTIKOSTEROIDOV I BIOGENNYKH AMINOV V PLAZME KROVI KRYS PRI STRESSE]
G. V. TIULENEVA, N. M. DOROSHENKO, and V. V. KORPACHEV (Kievskii Institut Endokrinologii i Obmena Veshchestv, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, July-Aug. 1988, p. 47-50. In Russian. refs

The role of the spleen in regulating the contents of 11-oxycorticosteroid (11-OCS) and biogenic amines (such as histamine and serotonin) in blood was investigated in intact and splenectomized rats, unstressed or stressed by forced swimming. It was found that swimming for 1-5 hr increased plasma concentration of 11-OCS, with a maximal increase occurring after 2 hrs. Splenectomy led to a decrease of the adrenal mass and of 11-OCS content in blood, but the dynamics of the 11-OCS concentration response to stress remained similar to that of intact controls. The application of stress also induced increases of both biogenic amines in blood, with histamine increasing in the first hour and serotonin in the 4th to 5th hour. Splenectomy led to lowering of blood histamine in both nonstressed and stressed rats. Serotonin, on the other hand, was not reduced by splenectomy; its concentration during stress was lower than in intact controls. I.S.

A88-50638
ROLE OF REGULAR MUSCULAR ACTIVITY ON THE RESIDUAL EFFECTS OF ADAPTATION TO COLD [VLIIANIE REGULIARNOI MYSHECHNOI DEIATEL'NOSTI NA SLEDOVYE EFFEKTY KHOLODOVOI ADAPTATSII]
V. I. SOBOLEV, G. I. CHIRVA, and V. A. ANOKHIN (Donetskii Gosudarstvennyi Universitet, Donetsk, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, July-Aug. 1988, p. 56-61. In Russian. refs

The stability of the parameters of adaptation to cold and the effect of regular exercise on these parameters were investigated in rats kept for 28 days at 2 C followed by a postadaptation period of up to 30 days during which rats in experimental group were exercised on a treadmill (50 min daily runs at 20 m/min). To monitor the effects of adaptation, the calorigenic norepinephrine effect, the cooling rate at -25 C, the working hyperthermia level, and the weights of the interscapular brown fatty tissue, the thyroid gland, and the heart were determined on the 1st, 10th, 20th, and 30th days of postadaptation. It was found that regular muscular activity in the postadaptation period accelerated the extinction of the basic physiological changes developed during adaptation to cold. I.S.

A88-50639
PROTECTIVE EFFECT OF ADAPTATION TO HIGH-ALTITUDE HYPOXIA IN CASES OF CARDIAC ARRHYTHMIAS AND FIBRILLATION [ZASHCHITNOE DEISTVIE ADAPTATSII K VYSOTNOI GIPOKSII PRI ARITMIIAKH I FIBRILLIATSII SERDTSA]
F. Z. MEERSON, E. E. USTINOVA, E. KH. ORLOVA, I. I. ROZHITSKAIA, and M. E. EVSEV'EVA (AMN SSSR, Institut Obshchei Patologii i Patofiziologii, Moscow, USSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, July-Aug. 1988, p. 71-78. In Russian. refs

This paper investigates the effect of adaptation to high-altitude hypoxia on the stability of the rat heart to arrhythmogenic stress and acute ischemia, as well as on persistent disturbances of cardiac electrical stability caused by postinfarctal cardiosclerosis. It is shown that the stepwise adaptation of postinfarct animals to altitude-chamber hypoxia (2-hr-long exposures to 1000 m for 1-2

days followed by exposures to higher altitudes, increasing the altitude level by 1000 m every 2 days up to 5000-m maximum and then gradually increasing the time exposures up to 6 hr) prevented a poststress decrease in the electric threshold of the heart fibrillation and decreased mortality of rats. Adaptation to hypoxia also considerably increased the concentration of beta-endorphine in adrenal glands and lowered the stress-induced decline of beta-endorphine concentration in the brain. I.S.

A88-50640
ABNORMALITIES OF NEUROENDOCRINAL REGULATION AND HORMONAL RESERVES IN RATS DURING BODY OVERHEATING [NARUSHENIIA NEIROENDOKRINNOI REGULIATSII I GORMONAL'NYKH REZERVOV SEMENNIKOV KRYS PRI OBSHCHEM PEREGREVANII]
A. G. REZNIKOV, S. K. KOBIAKOV, and P. V. SINITSYN (Kievskii Institut Endokrinologii i Obmena Veshchestv, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 34, July-Aug. 1988, p. 78-83. In Russian. refs

A88-50645
STRESS-DEVELOPMENT MECHANISMS [MEKHANIZMY RAZVITIIA STRESSA]
F. I. FURDUI, ED. (AN MSSR, Institut Zoologii i Fiziologii, Kishinev, Moldavian SSR) Kishinev, Izdatel'stvo Shtiintsa, 1987, 224 p. In Russian. For individual items see A88-50645 to A88-50651.

The mechanisms of stress development are considered, with special attention given to the roles of endocrine and immune systems in the development of stress reactions. Mechanisms of adaptation reactions developed in the course of long-duration space flights are discussed together with the systemic mechanisms of emotional stress, and the relationship between the drug-dependent stress-resistance of animals and the type of emotional-behavioral reactivity. Consideration is also given to mechanisms of stress mediation, the interhemisphere organization of emotional stress, physiological mechanisms of stress development in early postnatal ontogenesis, the role of the cerebellum in stress-development mechanisms, and mechanisms of gastrointestinal disorders during stress. I.S.

A88-50646
MODERN CONCEPTS CONCERNING THE PHYSIOLOGICAL MECHANISMS OF STRESS DEVELOPMENT [SOVREMENNYE PREDSTAVLENIIA O FIZIOLOGICHESKIKH MEKHANISMAKH]
F. I. FURDUI (AN MSSR, Institut Zoologii i Fiziologii, Kishinev, Moldavian SSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 8-33. In Russian. refs

This paper discusses various schemes of the classification of stress reactions together with various types of stress. Special attention is given to the mechanisms of the development of reactions to various causes of stress and to the roles of various physiological systems and organs in the formation of stress reaction. Changes induced by stress in the physiology of important life systems are discussed together with the role of stress in the development of adaptation reactions, in the maintenance of homeostasis, and in the development of pathological disorders. Various stages of the stress development process are examined. I.S.

A88-50648
SYSTEMIC MECHANISMS OF EMOTIONAL STRESS [SISTEMNYE MEKHANIZMY EMOTSIONAL'NOGO STRESSA]
K. V. SUDAKOV, E. A. IUMATOV, and L. S. UL'IANINSKII (AMN SSSR, Nauchno-Issledovatel'skii Institut Normal'noi Fiziologii, Moscow, USSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 52-79. In Russian. refs

The dynamics of cardiovascular disorders observed in rats and rabbits under conditions of acute or chronic emotional stress (due to enforced immobilization and/or electric shocks) were investigated by monitoring hemodynamic, metabolic, electrophysiological, and structural changes brought about in myocardium. Special attention was given to the identification of differences observed in individual animals caused by individual or genetic factors and of the criteria of resistivity to emotional stress. Measures effective in raising the stability of the cardiac activity to emotional stress are suggested. I.S.

A88-50649
DEPENDENCE OF THE DRUG-DEPENDENT STRESS RESISTANCE IN ANIMALS ON THE TYPE OF EMOTIONAL-BEHAVIORAL REACTIVITY AND THE PHASE CHARACTER OF THE STRESS REACTION [ZAVISIMOST' FARMAKOLOGICHESKI OBUSLOVLENNOI STRESSOUSTOICHIVOSTI ZHIVOTNYKH OT TIPA EMOTSIONAL'NOPOVEDENCHESKOI REAKTIVNOSTI I FAZNOSTI PROTEKANIIA STRESS-REAKTSII]
A. V. VAL'DMAN, N. A. BONDARENKO, and L. A. MALIKOVA (AMN SSSR, Nauchno-Issledovatel'skii Institut Farmakologii, Moscow, USSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 79-99. In Russian. refs

The effects of azaperone, haloperidol, clozapine, and aminazin on the manifestations of stress (including decreases of body mass and the masses of adrenal and thymus glands, the appearance of gastric bleeding, and gastric hyperemia) on the various stages of stress reaction in immobilized rats were investigated, with special attention given to the differences displayed by the animals grouped in the categories of emotional and nonemotional psychotic types. It was found that, during the second stage of stress reaction, i.e., the stage of anxiety and adaptation, all drugs exhibited a protective effect. The type of emotional-behavioral reactivity determined the qualitative character of the adaptive activity of the stressed animal and its resistance to chronic emotional stress. The stress-protective action of neuroleptics is considered to be related to the synthesis and/or release of catecholamines. I.S.

A88-50650
MECHANISMS OF STRESS MEDIATION [MEDIATORNYE MEKHANIZMY STRESSA]
S. KH. KHAIDARLIU (AN MSSR, Institut Zoologii i Fiziologii, Kishinev, Moldavian SSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 99-113. In Russian. refs

This paper discusses the roles of various neuromediating substances in stress-specific reactions, with special attention given to each class of neurotransmitters, including cholinaminergic and histaminergic systems, amino acids, and peptides. Among these substances the cholinergic system plays a predominant role in the initiation of the stress reaction. Its activity, however, depends on the modulating effects of monoamino- and peptide-type neurotransmitters. I.S.

A88-50651
STRESS AND THE IMMUNE SYSTEM [STRESS I IMMUNNAIA SISTEMA]
E. V. BAEVA and G. M. BABARE (AN MSSR, Institut Zoologii i Fiziologii, Kishinev, Moldavian SSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 189-205. In Russian. refs

The effects of different types of stress on the functional activity of T- and B-lymphocyte populations (estimated by mutagen-induced DNA synthesis) were investigated in rats subjected to stress by immobilization, forced swimming, hypothermia, and hyperthermia. It was found that the degree and the character of immunodepression depended on the nature of the stressor, its potency, and the duration of its effect. The role of glucocorticoid and thyroid hormones on the functional activity of immune cells is discussed. I.S.

N88-27356# Florida Univ., Gainesville. Dept. of Psychology.
PHYSIOLOGICAL MONITORING METHODOLOGY IN THE USAFSAM CENTRIFUGE Final Report
JENNIFER B. MCGOVERN *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 11 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06P

Loss of consciousness due to +Gz (G-LOC) was identified as a cause of many mishaps and loss of aircrews and aircraft. Previous

studies have suggested that physiological measures, especially the EEG, would be useful to monitor pilot consciousness. Appropriate methodologies (including electrode placement and choice of electrode) are defined for use in a USAFSAM Centrifuge study of deliberate G-LOC. Physiological signals to be monitored included EEG, EMG, EOG, ear oximetry, and respiratory sounds. Author

N88-27357# Brown Univ., Providence, R. I. Div. of Biology and Medicine.
METHODS OF QUANTIFYING AND ENHANCING REACTIVE OXYGEN SPECIES PRODUCTION Final Report
ROLAND A. MEDELLIN *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 20 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06P

Bioassays were run employing a reaction summarized by a given equation. Glucose oxidase, Horseradish peroxidase, Luminol, and Bovine serum albumin were immobilized on 7 mm filter paper disks. These disks when assayed by adding glucose demonstrated consistent, predictable enzyme kinetics, even when various inhibitors were added. A 150-fold greater chemiluminescence peaks were observed in disks to which glucose was added compared to controls. When Catalase was added, only 4.4 percent of this chemiluminescence was observed, while 15 percent of the chemiluminescence for glucose was seen when Bovine serum albumin was added. Virus sized nanoparticles (Glucose oxidase and Horseradish peroxidase) were produced along with a 1300-fold greater chemiluminescence over controls when a mixture of glucose and luminol was added. These nanoparticles were able to penetrate a 0.2 micron filter, and they retained their enzymatic activity for weeks. They produced 20-fold greater chemiluminescence over controls when immobilized on gel disks. Author

N88-27683# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.
ELECTRIC AND MAGNETIC ACTIVITY OF THE CENTRAL NERVOUS SYSTEM: RESEARCH AND CLINICAL APPLICATIONS IN AEROSPACE MEDICINE
Feb. 1988 404 p In ENGLISH and FRENCH Symposium held in Trondheim, Norway, 25-29 May 1987 Original contains color illustrations
(AGARD-CP-432; ISBN-92-835-0447-X) Avail: NTIS HC A18/MF A01

The physical and mental demands imposed on aircrew operating high performance combat aircraft will be severe. The heavy loads of information received from the aircraft sensors must be assimilated and managed in a timely and efficient manner. Severe physiological stresses will be imposed by the environment of rapid onset, high sustained G-acceleration. The purpose of this symposium was to explore the feasibility of using electrical potentials and magnetic fields of the central nervous system as objective measures of the human condition. Topics addressed include: the computer-aided imaging of background and evoked brain electrical activity; magnetoencephalography; the functional significance of P300, contingent negative variation (CNV), and electroencephalogram (EEG) events as indices of behavior; the use of physiological measures for indexing in-flight and simulator mission effectiveness; and the effects of acceleration, drugs, and diseases on CNS.

N88-27722# Jackson Lab., Bar Harbor, Maine.
GENETIC EFFECTS OF LOW LEVEL MICROWAVE RADIATION Annual Report, Mar. 1987 - Mar. 1988
JEFFERY D. SAFFER 1 Mar. 1988 5 p
(Contract N00014-87-K-0145; S40-0021)
(AD-A192687) Avail: NTIS HC A02/MF A01 CSCL 06G

We have developed a biological model system for examining the effects of electromagnetic radiation at the cellular level. This system features(1) a simple bacterial model with plasmid DNA which can be manipulated at the molecular level,(2) an assay which includes biological amplification for detecting subtle alterations, and(3) low variability usually inherent in biological assays. This system will now be used to study the effects of nondestructive free electron laser (FEL) radiation on biological processes in whole cells. We have tested the model system using microwave radiation and have been able to detect subtle changes in the plasmid-encoded Beta-galactosidase activity. The effect observed is not duplicated by bulk heating of the bacterial culture and there is no effect on purified Beta-galactosidase. GRA

N88-27723# Midwest Research Inst., Golden, Colo.
AN OUTDOOR TEST FACILITY FOR THE LARGE-SCALE PRODUCTION OF MICROALGAE
D. A. JOHNSON, J. WEISSMAN, and R. GOEBEL Mar. 1988 12 p Presented at the Energy From Biomass and Wastes, New Orleans, La., 15 Feb. 1988 Prepared in cooperation with Microbial Products, Inc., Fairfield, Calif.
(Contract DE-AC02-83CH-10093)
(DE88-001146; SERI/TP-231-3325; CONF-880215-4) Avail: NTIS HC A03/MF A01

The goal of the U.S. Department of Energy Solar Energy Research Institute's Aquatic Species Program is to develop the technology base to produce liquid fuels from microalgae. This technology is being initially developed for the desert Southwest. As part of this program an outdoor test facility was designed and constructed in Roswell, New Mexico. The site has a large existing infrastructure, a suitable climate, and abundant saline groundwater. This facility will be used to evaluate productivity of microalgae strains and conduct large-scale experiments to increase biomass productivity while decreasing production costs. Six 3-sq m fiberglass raceways were constructed. Several microalgae strains were screened for growth, one of which had a short-term productivity rate of greater than 50 g dry wt/sqm/d. Two large-scale, 0.1-ha raceways were also built. These are being used to evaluate the performance trade-offs between low-cost earthen liners and higher cost plastic liners. A series of hydraulic measurements is also being carried out to evaluate future improved pond designs. Future plans include a 0.5-ha pond. This facility will be available to other researchers and industry for studies on microalgae productivity. DOE

N88-27724# Pennsylvania Univ., Philadelphia. Dept. of Biochemistry and Biophysics.
FACTORS GOVERNING LIGHT DRIVEN ELECTRON AND PROTON TRANSLOCATION IN PROTEINS ACROSS MEMBRANES
P. L. DUTTON 1988 25 p
(Contract DE-AC02-80ER-10590)
(DE88-011120; DOE/ER-10590/2) Avail: NTIS HC A03

A series of preliminary studies showed that both the direct electrical and the Q(sub A) replacement avenues of approach were feasible. That the reaction centers could be incorporated in planar bilayer membranes to a density of approximately 10 to the 9th power sq cm was determined and with metal electrodes on either side of the supporting membranes flash activated voltages and transient currents could be monitored. The reaction centers were deposited in a 50:50 mix of vectorially opposing populations. By this approach, simple optical studies cannot easily be performed on the film either alone or simultaneous with electrical assay. The successful construction of reaction center mono (and multi) layers formed in a Langmuir Blodgett trough and deposited on planar solid supports was demonstrated. A simple spectrophotometric analysis was done on the dry film. Direct transmission assay of the optical properties of single monolayers supported the finding of approximately 5 x 10 to the 12th power reaction centers/sq cm; linear dichroism showed that the orientation of the reaction center chromophores were as found in vivo. The reaction centers responded to flash activation. DOE

N88-27725# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE AND FUNCTION OF THE MANGANESE COMPLEX INVOLVED IN PHOTOSYNTHETIC OXYGEN EVOLUTION DETERMINED BY X-RAY ADSORPTION SPECTROSCOPY AND ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY Ph.D. Thesis
R. D. GUILES Apr. 1988 274 p
(Contract DE-AC03-76SF-00098)
(DE88-010360; LBL-25186) Avail: NTIS HC A12/MF A01

Water is the terminal electron donor in the linear light-driven electron transport chain used by higher plants, cyanobacteria and green algae to fix carbon dioxide. The involvement of a membrane-bound manganese-containing protein complex has been demonstrated at the site of water oxidation within the photosystem II (PSII) reaction center. The photosynthetic oxidation of water to molecular oxygen is believed to involve intermediate S-states (S sub 0 to S sub 4), of the oxygen evolving complex (OEC). The use of multiline EPR signal associated with Mn and assigned to the S sub 2 state has greatly facilitated structural characterization of the OEC. This thesis contains a description of methods used to cryogenically stabilize PSII preparations suitable for X-ray absorption spectroscopy in the S sub 1, S sub 2 and S sub 3 states as well as a state induced by hydroxylamine resembling the S sub 0 state of the OEC. Studies of the Mn K-edges of PSII preparations indicate that a light-induced oxidation of Mn occurring during the S sub 1 yield S sub 2 state transition corresponds to a formal valence change from Mn(III) to Mn(IV). An analysis of the extended X-ray absorption fine structure (EXAFS) of the Mn complex within PSII preparations poised in the S sub 1, S sub 2, S sub 3 and hydroxylamine-induced S sub 0 states indicates that the four manganese present are organized as two di-mu-oxo bridged binuclear managanese complexes. An essential component of the analysis of the EXAFS was a parallel analysis of a set of crystallographically characterized multinuclear mu-oxo bridged manganese complexes. Based on conclusions drawn from the analysis of the Mn K-edge and EXAFS of PSII preparations cryogenically stabilized in the S-states described above, a model for the mechanism of photosynthetic water oxidation is presented. DOE

N88-28606# Army Research Inst. of Environmental Medicine, Natick, Mass.
PLASMA VOLUME EXPANSION IN RATS: EFFECTS ON THERMOREGULATION AND EXERCISE
R. P. FRANCESCONI, M. BOSSELAERS, C. MATTHEW, and R. HUBBARD Feb. 1988 25 p
(AD-A192656) Avail: NTIS HC A03/MF A01 CSCL 06J

Administration of polyethlene glycol (PEG, intraperitoneal, 3ml, 30 percent solution) to adult, male rats (300g) resulted in an approximate 20 percent increment in plasma volume (PV) 24 h after PEG injection. When these animals were exercised (9.14 m/min, level treadmill) in a warm 30 C, 30 to 40 percent rh) environment, their mean endurance was increased from 67.9 min (saline-treated controls, CONT) to 93.6 min. Total water loss was increased from 12.2g (CONT) to 17.2 g (PEG). Atropine administration (ATR, 200 ug/kg, tail vein) significantly reduced both the endurance and the salivary water loss of CONT and PEG-treated rats while increasing the heating rate of both groups. PEG treatment reduced the hematocrit and circulating protein levels both prior and subsequent to exercise in the warm environment. Clinical chemical indices of heat/exercise injury were generally unaffected by pharmacological intervention while clinical chemical responses to exercise were related to the endurance time of each group. We concluded that expansion of PV by PEG provided significant beneficial effects on performance and thermoregulation during exercise in a warm environment. GRA

N88-28607*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSIOLOGY OF PROLONGED BED REST
J. E. GREENLEAF Aug. 1988 11 p
(NASA-TM-101010; A-88214; NAS 1.15:101010) Avail: NTIS HC A03/MF A01 CSCL 06C

Bed rest has been a normal procedure used by physicians for centuries in the treatment of injury and disease. Exposure of patients to prolonged bed rest in the horizontal position induces adaptive deconditioning responses. While deconditioning responses are appropriate for patients or test subjects in the horizontal position, they usually result in adverse physiological responses (fainting, muscular weakness) when the patient assume the upright posture. These deconditioning responses result from reduction in hydrostatic pressure within the cardiovascular system, virtual elimination of longitudinal pressure on the long bones, some decrease in total body metabolism, changes in diet, and perhaps psychological impact from the different environment. Almost every system in the body is affected. An early stimulus is the cephalic shift of fluid from the legs which increases atrial pressure and induces compensatory responses for fluid and electrolyte redistribution. Without countermeasures, deterioration in strength and muscle function occurs within 1 wk while increased calcium loss may continue for months. Research should also focus on drug and carbohydrate metabolism. Author

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AEROSPACE MEDICINE

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

A88-49751* Johns Hopkins Univ., Baltimore, Md.
CHANGES IN PLASMA VOLUME DURING BED REST - EFFECTS OF MENSTRUAL CYCLE AND ESTROGEN ADMINISTRATION
S. M. FORTNEY, W. S. BECKETT, A. J. CARPENTER, J. DAVIS, H. DREW (Johns Hopkins University, Baltimore, MD) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 65, Aug. 1988, p. 525-533. refs
(Contract NAS9-16703; NAS9-17199)

The effect of increased blood estrogen concentration, caused either during normal menstrual cycles or by exogenous administration of premarin, on the bed-rest (BR) induced decrease in plasma volume (PV) was investigated. In women who underwent duplicate 11-day BR without estrogen supplementation, the PV was found to decrease significantly, during the first 5 days of BR, to a lower level at which it remained for the rest of the BR period. In women who began BR in the periovulatory stage of the menstrual cycle, the loss of PV was delayed, while women who began BR during other stages of the cycle exhibited the usual trend of the PV decrease during the BR. In women who underwent a single 12-day BR period while taking premarin (1.25 mg/day), PV was found to decrease during the first 4-5 days of BR, but then returned toward the pre-BR level during the remainder of the BR, indicating that estrogens have a role in stabilizing body fluid volume. I.S.

A88-49752
INFLUENCE OF SKELETAL MUSCLE GLYCOGEN ON PASSIVE REWARMING AFTER HYPOTHERMIA
P. DARRELL NEUFER, ANDREW J. YOUNG, MICHAEL N. SAWKA, and STEPHEN R. MUZA (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Journal of Applied Physiology (ISSN 0161-7567), vol. 65, Aug. 1988, p. 805-810. refs

The effect of muscle glycogen (MG) depletion on the thermal responses of humans to passive rewarming subsequent to mild hypothermia was investigated. The experiments, which included two 180-min immersions in 18 C water followed by 75 min of rest in a blanket at 24 C air temperature, were conducted in subjects who followed several days of different exercise-diet regimens leading to either low MG, or normal MG levels. The results

demonstrated that the rate of passive rewarming subsequent to mild-to-moderate hypothermia was not impaired by low glycogen levels in skeletal muscle. Moreover, afterdrop responses occurring during the initial period of rewarming were not altered by the difference in MG content. The findings suggest that individuals suffering from mild hypothermia will spontaneously rewarm despite significant MG depletion. I.S.

A88-49780* Pittsburgh Univ., Pa.
INDUCING JET LAG IN THE LABORATORY - PATTERNS OF ADJUSTMENT TO AN ACUTE SHIFT IN ROUTINE
TIMOTHY H. MONK (Western Psychiatric Institute and Clinic, Pittsburgh, PA), MARGARET L. MOLINE (Cornell University, White Plains, NY), and R. CURTIS GRAEBER (NASA, Ames Research Center, Moffett Field, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 703-710. refs
(Contract NCC2-253)

Eight middle-aged males were studied in a temporal isolation experimental lasting 15 d. After 5 d and nights of entrainment to his own habitual routine, each subject experienced an acute unheralded 6-h phase advance in routine, accomplished by truncating his sixth sleep episode. For the remaining 10 d of the study, subjects were held to a routine 6-h phase advanced to the original. Significant symptoms of jet lag appeared in mood, performance efficiency, sleep, and circadian temperature rhythms. When plotted as a function to days postshift, some variables showed a fairly monotonic recovery to baseline levels, but other variables showed a zig-zag recovery pattern, suggesting the interaction of two competing processes, and reinforcing the need for greater sophistication in the development of jet-lag coping strategies. Author

A88-49781
ACCELERATION TOLERANCE OF ASYMPTOMATIC AIRCREW WITH MITRAL VALVE PROLAPSE AND SIGNIFICANT +GZ-INDUCED VENTRICULAR DYSRHYTHMIAS
JAMES E. WHINNERY (USAF, Air University, Maxwell AFB, AL) and JAMES R. HICKMAN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 711-717. refs

Results are reported from centrifuge +Gz stress tests on eight aircrew members who were asymptomatic but had mitral-valve prolapse (MVP) and exhibited advanced ventricular ectopy (AVE) during the tests. The data are presented in extensive tables and analyzed in detail with reference to results on normal subjects and subjects with MVP but no +Gz-induced AVE. The subjects with MVP and AVE are shown to have lower overall tolerance to +Gz, with a significant difference in the values for a gradual-onset test using an anti-G straining maneuver; AVE occurred most frequently during the poststress period. It is recommended that candidates with both MVP and +Gz-induced AVE not be selected for training as combat-aircraft pilots. T.K.

A88-49782
EFFECTS OF BETA-ADRENERGIC BLOCKADE ON VENTILATION AND GAS EXCHANGE DURING INCREMENTAL EXERCISE
STEPHEN DODD, SCOTT POWERS, NANCY O'MALLEY, ELLEN BROOKS, and HOWARD SOMMERS (Louisiana State University, Baton Rouge) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 718-722. refs

Results are reported from open-circuit measurements of ventilation and gas exchange during bicycle-ergometer incremental-exercise tests on nine male subjects, with and without 1 mg/kg of the beta-adrenergic blocker propranolol hydrochloride. The data are presented in tables and graphs and analyzed. It is found that the blocker produced a significant decrease in maximum heart rate, leading in turn to lower peak O2 uptake, peak CO2 output, and time to exhaustion, but had little or no effect on the exercise ventilation parameters. T.K.

A88-49785
INFLUENCE OF BODY TILT WITHIN THE SAGITTAL PLANE ON ODOR IDENTIFICATION PERFORMANCE
ANDREW F. MESTER, RICHARD L. DOTY, AARON SHAPIRO, and RICHARD E. FRYE (Pennsylvania, University, Philadelphia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 734-737. refs
(Contract NIH-NS-16365)

Odor identification performance, nasal airflow resistance, blood pressure, and heart rate were assessed in 8 men and 8 women in the following body tilt positions within the sagittal plane: 0 deg (upright), 90 deg (supine), 135 deg, and 180 deg (upside down). The order of testing across the tilt conditions was systematically counterbalanced using a Latin-square procedure. Average odor identification performance decreased monotonically as a function of increased body tilt. Significant decreases in heart rate and blood pressure were observed as the body was tilted from the upright condition, although blood pressure was equivalent in the upright and upside down conditions. Nasal resistance was highly variable and was not systematically altered as a function of body tilt. These data support the hypothesis that olfactory function, like visual, auditory, and vestibular function, is significantly influenced by body position within a gravitational field. Author

A88-49786
THE EFFECTS OF COLD IMMERSION AND HAND PROTECTION ON GRIP STRENGTH
M. J. VINCENT and M. J. TIPTON (Institute of Naval Medicine, Gosport, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 738-741. refs

A88-49787
PREDICTION OF HUMAN THERMOREGULATORY RESPONSES AND ENDURANCE TIME IN WATER AT 20 AND 24 C
PETER TIKUISIS, RICHARD R. GONZALEZ, and KENT B. PANDOLF (DND, Defence and Civil Institute of Evironmental Medicine, Downsview, Canada; U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 742-748. refs

A multicompartmental mathematical model for predicting human thermoregulatory responses was applied to immersion in moderately cold water. Data were used from experiments where eight healthy male volunteers were immersed nude and up to the neck for 1 h in water at 20 and 24 C under conditions of rest and exercise. Rectal temperature and metabolic rate were measured before and during immersion. Once agreement between the model prediction and experimental observation was obtained, the model was used for prediction beyond the duration of the experiment. Stabilization of core temperature was predicted after 4-5 h of immersion for rest and after 2-4 h for exercise. Stabilization for resting individuals has been observed in other experiments under similar conditions. These results suggest that linear extrapolations based on linear body cooling rates are inadequate for predicting endurance times in moderately cold water. In this study, predicted endurance times were based on the concept of relative exercise intensity and are in agreement with the limited data available. Author

A88-49788
INTENSITY JUDGMENTS OF VIBRATIONS IN THE X AXIS, Z AXIS, AND X-PLUS-Z AXES
RICHARD W. SHOENBERGER (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 749-753. refs
(Contract F33615-82-C-0504)

Seated subjects matched their perceptions of the intensity of X-axis, Z-axis, or X + Z vibrations by adjusting the intensity of a sinusoidal (5-Hz) Y-axis response vibration. Stimuli were sinusoidal at 3.2, 5, and 8 Hz. For each frequency there were six vibration conditions (X axis alone, Z axis alone, or both axes together with 0, 90, 180, or 270-deg phase angles between them), each

presented at each of two acceleration levels (0.15 and 0.25 G rms). Results showed that Y-axis response accelerations for the dual-axis stimuli were greater than those for either one of their X-axis or Z-axis components. However, the pattern of results indicated that response acceleration varied significantly as a function of the combination of phase angle and frequency.
Author

A88-49789
A COMPARATIVE STUDY OF G-INDUCED NECK INJURY IN PILOTS OF THE F/A-18, A-7, AND A-4
R. KNUDSON, D. MCMILLAN, D. DOUCETTE, and M. SEIDEL (U.S. Navy, Aviation Medicine Div., Lemoore, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 758-760.

The introduction of the high-performance F/A-18 has brought attention to the problem of high +Gz-induced neck pain and injury. Aviators were surveyed, and the results were categorized by aircraft type. It was found that 74 percent of F/A-18 aviators surveyed reported neck pain with high +Gz. Out of 37 pilots reporting neck injury, 11 required removal from flight status averaging 3 days. The inability to function effectively during high-G flight and the impact of lost pilot days highlight the need for further study into the prevalence of and solutions for high +G-induced neck injury.
Author

A88-49790
SPONTANEOUS CHANGES IN ATRIOVENTRICULAR CONDUCTION IN A PILOT WITH INTERMITTENT CONCEALED PREEXCITATION SYNDROME
SERGIUSZ BOJENKO, LECH KOPKA, ROMUALD DABROWA, and ROMUALD SWIERZEWSKI (Wojskowy Instytut Medycyny Lotniczej, Warsaw, Poland) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 761-765. refs

A case of a 36-year-old pilot with a left-sided accessory pathway (Kent bundle) is presented. The electrophysiological study revealed spontaneous changes in atrioventricular conduction in both the accessory and physiological pathways, lack of retrograde conduction via the accessory pathway, and constant ventriculoatrial block in the atrioventricular node during pacing tests of the right ventricular apex. The influence of the autonomic nervous system on the accessory pathway conduction as well as the clinical and electrophysiological aspects of the phenomenon observed are discussed.
Author

A88-50509
CARDIOVASCULAR RESPONSES TO ACCELERATION STRESS: A COMPUTER SIMULATION
DOV JARON, THOMAS W. MOORE (Drexel University, Philadelphia, PA), and JING BAI (Tsinghua University, Beijing, People's Republic of China) IEEE, Proceedings (ISSN 0018-9219), vol. 76, June 1988, p. 700-707. refs
(Contract N00014-85-K-0566)

Engineering methodology was used to develop a mathematical model of the cardiovascular system which is capable of predicting the effects of acceleration stress on peripheral and central vision. The basic model, previously reported, has been extended to include a simulation of the venous system and a number of additional refinements. It includes simulations of the heart, arterial, and venous system, physiologic compensatory mechanisms, and the effects of protective devices and maneuvers. Information derived from the model is important to understanding of cardiovascular responses to acceleration stress, mechanisms which determine tolerance, and factors which limit a pilot's performance. The model has been used to study the relative effectiveness of several acceleration protection methods and devices, including an anti-G suit design. Results from simulations using the model correlate well with reports in the literature.
I.E.

A88-50633
ULTRASLOW MODULATIONS OF EEG AND EKG PARAMETERS IN STUDIES OF THE FUNCTIONAL STATE OF HEALTHY INDIVIDUALS [SVERKHMEDLENNYE MODULIATSII PARAMETROV EEG I EKG V ISSLEDOVANIIAKH FUNKTSIONAL'NOGO SOSTOIANIIA ZDOROVYKH LITS]
A. M. ZUFRIN, S. B. IL'IN, O. S. RAEVSKAIA, and S. IU. SHTIURMER (Tol'iattinskii Politekhnicheskii Institut, Tolyatti, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, July-Aug. 1988, p. 552-561. In Russian. refs

A technique is described for the isolation of ultraslow modulations (USMs) from EEGs and EKGs recorded by conventional methods. Using a specially designed method of cross-correlation analysis, it was found that some USMs have a controlling role at different phases of the individual's activity and in different functional states. It is shown that the method can be used to analyze in detail the coupling between different physiological systems taking place during the process of adaptation.
I.S.

A88-50634
INDIVIDUAL VARIABILITY OF VESTIBULAR SENSITIVITY DETERMINED FROM SUBJECTIVE PERCEPTIONS AND LONG-LATENCY VESTIBULAR EVOKED POTENTIALS [INDIVIDUAL'NAIA VARIABEL'NOST' VESTIBULIARNOI CHUVSTVITEL'NOSTI PO SUB'EKTIVNYM OSHCHUSHCHENIIAM I DLINNOLATENTNYM VESTIBULIARNYM VYZVANNYM POTENTSIALAM]
K. F. TRINUS (Kievskii Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevanii, Kiev, Ukrainian SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, July-Aug. 1988, p. 562-568. In Russian. refs

The subjective thresholds of sensitivity and the long-latency vestibular evoked potentials (VEP) were measured in humans subjected to linear vertical acceleration. It was found that the least individualized parameter was the threshold of reverse perception, while the threshold of VEP and the threshold of discriminate perceptions were most individualized. It was found that individuals with greater latent periods of VEP peaks usually display greater variability of the latent-period VEP peaks.
I.S.

A88-50635
THE BIORHYTHM CHARACTERISTICS OF THE DYNAMICS OF RESPIRATION PARAMETERS IN HUMANS IN THE COURSE OF A PASSIVE ORTHOSTATIC TEST [BIORITMOLOGICHESKIE OSOBENNOSTI DINAMIKI POKAZATELEI VNESHNEGO DYKHANIIA CHELOVEKA PRI VYPOLNENII PASSIVNOI ORTOSTATICHESKOI PROBY]
V. A. GALICHII Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, July-Aug. 1988, p. 577-585. In Russian. refs

The dynamic changes of the respiration parameters that take place during passive orthostatic test were analyzed in healthy men aged 26-40. The changes observed were characterized by variations of the measured parameters in a range close to one minute, including both increases and decreases in the values relative to the control levels. It is suggested that the values for the depth and the duration of the negative phases in the minute oxygen volume and in the coefficient of oxygen utilization observed during the test may be used as criteria of the efficiency of hemodynamic compensation shifts caused by horizontal-to-vertical position changes.
I.S.

A88-50636
ASYMMETRY IN THE TIME DISTRIBUTION OF A SIMPLE SENSOMOTOR REACTION [ASIMMETRIIA RASPREDELENII VREMENI PROSTOI SONSOMOTORNOI REAKTSII]
V. I. LUPANDIN and O. E. SURNINA (Ural'skii Gosudarstvennyi Universitet, Sverdlovsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 14, July-Aug. 1988, p. 700-702. In Russian.

It was previously reported that the distribution function of the reaction time (RT) in an auditory signal test taken by a large group of individuals did not fit a Gaussian curve but exhibited a definite asymmetry. In this paper, the distributions of RTs for each

of 12 individual subjects, in response to auditory signals of different intensity, were investigated in the course of a long-duration experiment. It was found that the individual RT distribution curves exhibited positive asymmetry, with the greatest asymmetry coefficient corresponding to the loudest-signal RT. I.S.

A88-50647
PERIODIZATION AND CLASSIFICATION OF THE ADAPTATION REACTIONS OF THE HUMAN ORGANISM IN THE COURSE OF LONG-TIME SPACE FLIGHTS [PERIODIZATSIIA I KLASSIFIKATSIIA PRISPOSOBITEL'NYKH REAKTSII ORGANIZMA CHELOVEKA V DLITEL'NYKH KOSMICHESKIKH POLETAKH]
O. G. GAZENKO, A. I. GRIGOR'EV, and A. D. EGOROV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IN: Stress-development mechanisms. Kishinev, Izdatel'stvo Shtiintsa, 1987, p. 33-52. In Russian. refs

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

A88-51009#
A METHODOLOGY FOR THE REDUCTION OF FALSE ALARM RATES IN ARTIFICIAL INTELLIGENCE-BASED LOSS OF CONSCIOUSNESS MONITORING SYSTEMS
R. E. VAN PATTEN (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 881-884. refs

A rationale, based on physiological data, is discussed for the design of a maneuver space boundary such that air combat maneuvers within that boundary will constitute an indicator that a G-induced loss of consciousness (GLOC) is unlikely. Maneuvers performed above that space (of G's and time) will serve to confirm indications from other sensors that a GLOC is possible and likely. I.E.

A88-51011#
EYEBLINK MONITORING AS A MEANS OF MEASURING PILOT PHYSIOLOGICAL STATE
PATRICK M. O'BRIEN (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 890-892.

The results of a study to determine whether the pilot loss of consciousness (PLOC) monitor is an effective means of detecting G-induced loss of consciousness through monitoring a pilot's eyeblink are presented. The PLOC monitor uses an oxygen-mask-mounted infrared emitter/receiver and a microprocessor to collect and process the light reflected from the eyelid and sclera to determine when a blink occurs. The method used was to instrument centrifuge subjects for EOG and monitor the output under sustained acceleration levels from 3 to 7 G using the PLOC monitor. The PLOC monitor detected better than 90 percent of subject blinks during the test. There was no statistically significant difference in performance due to acceleration level or eye color, and no artifact from movement or speech. The PLOC monitor performed well under sustained acceleration and shows potential for use in an in-flight pilot-physiological-state monitoring system. I.E.

A88-51012#
ANTI-G SUIT PRESSURE - HOW MUCH IS JUST RIGHT?
JOHN W. FRAZIER, TRACY GORDON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and LARRY J. MEEKER (USAF, School of Aerospace Medicine, Brooks AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 897-902. refs

The early development of anti-G suits and G-valves is reviewed, as well as contemporary research on advanced anti-G protection systems. The classic works of Wood, Hallenbeck, and others in the 1940s resulted in the basic anti-G-suit and inflation schedules still in use in the USAF. The standard mechanical G-valve senses the Gz level and regulates G-suit pressure in at a linear rate of 1.5 psi/Gz. Currently, numerous anti-G valves utilizing modern control techniques are under development. Microprocessors are being advocated to monitor the aircraft status and thereby control the G-suit inflation. It is possible that additional inputs such as onset rate, anticipated peak Gz, seat-back angle, time at G, individual variability, comfort, and the pilot's physiologic status should also be considered in determining the optimum anti-G-suit inflation parameters. A nonlinear anti-G-suit inflation rate, pre-inflation, and sequential or pulsating pressure schedules could also be utilized by new concept valves, and may result in techniques to provide improved protection to the pilot against G-induced loss of consciousness. I.E.

N88-27361# Kansas State Univ., Manhattan. Dept. of Psychology.
A HUMAN FACTORS EVALUATION OF THE ADVANCED VISUAL TECHNOLOGY SYSTEM (AVTS) EYE TRACKING OCULOMETER Final Report
JEROME I. NADEL *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 19 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06N

A human factors evaluation of the Honeywell helmet mounted eye tracking oculometer system was conducted. Experimental tests were directed at identifying the physical and anthropometric factors that lead to both successful and unsuccessful oculometer operability. Pupil size of the user was found to be the most significant factor affecting system performance. Other factors affecting system performance were interpupillary distance and helmet fit. It was recommended that the electronic pupillary signal from the system IR camera be amplified. This, in combination with a lower system pupil threshold, should ensure measurement accuracy for at least 80 percent of the user population. Author

N88-27363# Meharry Medical Coll., Nashville, Tenn. School of Medicine.
MICROESOTROPIA PATIENTS PERFORMA WELL AS MILITARY JET PILOTS Final Report
BERNADETTE P. T. NJOKU *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 10 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06N

A computer listing of patients examined with the diagnosis of microesotropia (microstrabismus, monofixation syndrome) was obtained. Key terms, especially used to determine patients not clearly defined as microesotropics include: failed depth perception, anisometropia, esotropia/esophoria, strabismus, microexotropia, hyperopia/hypermetropia, suppression/amblyopia, monofixation syndrome, diplopia, heterotropia/strabismus, and failed red lens test. The patients charts, mainly pilots and navigators, were studied and specific data gathered, then transferred to individual microstrabismus data sheets. From this, 6 straightforward graphs are constructed: refraction spherical equivalent vs patient no., refraction cylinder astigmatism vs patient no., Verhoeff vs patient

no., Howard-Dolman vs patient no., alignment vs patient no., and stereo arc/sec vs patient no. These data and graphs allow primarily for at-a-glance obtaining of quantified information and comparisons from patient to patient; and thus, subsequent in-depth judgement and theories. Author

N88-27368# Nebraska Univ., Lincoln. Dept. of Electrical Engineering.
INFLUENCE OF MOVING VISUAL ENVIRONMENT ON SACCADIC EYE MOVEMENTS AND FIXATION Final Report
KEITH A. RIESE *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 15 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06N

Saccade parameters of amplitude, peak velocity, duration, and latency were compared for a stationary visual background environment versus a moving visual background environment to determine environmental effects. For visual stimuli, latency differences were significant while all other parameter variations were not. Mean saccade latency for a stationary visual background was 161.7 msec while for a moving visual background the mean latency was 175.3 msec. Saccades made in the same direction as the moving background showed minor variation as compared with those made in the opposite direction. No significant differences in saccade parameters were found when audio stimuli were used. Also, no parameter significance was found between target fixation and pseudo target fixation. Author

N88-27369# Alabama Univ., Scottsboro. Dept. of Health, Physical Education and Recreation.
THERMAL STRESS AND ITS EFFECTS ON FINE MOTOR SKILL AND DECODING TASKS
M. CAROLYN ROBINSON *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 17 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06N

The current thermal research has focused on work productivity as measured by the amount of time a subject is engaged in gross motor movement. To help determine if thermal stress has an effect on fine motor and cognitive skills, two tasks were utilized to measure any change in these skills. The fine motor skill task was a hand-eye steadiness task; the cognitive task was a decoding task. An examination of the data indicated that under the thermal stress induced by a work-rest protocol resulting in a cyclic body core temperature (Tre): (1) there appears to be a trend between Tre and fine motor performance; (2) there does not appear to be a trend between Tre and decoding performance. An examination of the data indicates that personnel experiencing a cyclic variation in Tre may preserve cognition functioning, but may suffer a decrement of steadiness performance. The results of the decoding task may be an indication that the task utilized is not sensitive to Tre. Author

N88-27387# Wright State Univ., Dayton, Ohio. School of Medicine.
HUMAN RESPONSE TO PROLONGED MOTIONLESS SUSPENSION IN FOUR TYPES OF FULL BODY HARNESSES Final Report
TERRI WILKERSON *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 20 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 06N

The ability to withstand prolonged suspension while being restrained by fall protection harnesses is of vital interest to occupational safety. A fallen worker may be suspended in a fall protection harness for an indefinite period waiting for rescue. The relative capabilities of four types of full body harnesses (FBH) were evaluated to provide occupant body support and restraint during post fall suspension. A series of 42 randomized tests were conducted to evaluate the physiological effects and subjective responses to prolonged, motionless suspension in four different designs of FBH. Measured physiological parameters included blood pressure, heart rate, and respiratory rate. Author

N88-27684# New York Univ., New York. Dept. of Psychology.
STUDIES OF THE INTACT HUMAN BRAIN: IMPLICATIONS FOR PERFORMANCE
LLOYD KAUFMAN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 17 p Feb. 1988
Avail: NTIS HC A18/MF A01

The development and testing of multi-channel neuromagnetometers are discussed in relationship to providing information needed concerning brain activity. Also discussed is the relationship between the number of sensing channels and the background noise. A brief account of some of the analytical methods applied to neuromagnetic data is provided. B.G.

N88-27685# New York Medical Coll., N.Y. Div. of Biological Psychiatry.
CEEG DYNAMIC BRAIN MAPPING: A NEW METHOD TO EVALUATE BRAIN FUNCTION IN DIFFERENT PSYCHOLOGICAL AND DRUG CONDITIONS
TURAN M. ITIL, KURT Z. ITIL, EMIN ERALP, A. AKMAN (HZI Research Center, Tarrytown, N.Y.), and A. MANCO *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 16 p Feb. 1988
Avail: NTIS HC A18/MF A01

The electroencephalogram (EEG), discovered more than half a century ago, is still the only non-invasive, simple and objective method to continuously and repetitively study brain function, and has recently gained new significance since quantification by microprocessors was developed. Quantification of single-lead EEG proved to be of significant value in psychotropic drug development. Discoveries of the psychotropic properties of drugs and the determination of bioavailability of CNS-active compounds validated this method. It was demonstrated that the brain's bioelectrical activity, even recorded in only one area of the brain, can represent brain function and is closely associated with human behavior. A newly-developed brain function monitoring system using multi-lead, broad frequency spectrum Computer-analyzed Electroencephalogram (CEEG) with Dynamic Brain Mapping seems to be a very promising methodology to study human behavior and to monitor its changes due to external and internal factors. Author

N88-27686# EEG Systems Lab., San Francisco, Calif.
FOURTH GENERATION NEUROCOGNITIVE PATTERN ANALYSIS SYSTEM
A. S. GEVINS, N. H. MORGAN, S. L. BRESSLER, D. S. GREER, B. COSTALES, K. SMITH, and R. FAUCETTE *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 13 p Feb. 1988 Original contains color illustrations
Avail: NTIS HC A18/MF A01

The generic term neurocognitive pattern (NCP) analysis is used to refer to procedures being developed to extract spatiotemporal neurocognitive patterns from the unrelated neuroelectric noise of the brain. Recordings with up to 64 scalp channels during highly controlled tasks are now routine in the laboratory, as is the extended signal processing sequence required to extract minute neurocognitive singals from gigabyte sets of single-trial data. More robust measures of the degree of functional interdependency between electrodes were developed and applied to several prior neuropsychological models of the rapidly shifting cortical network accompanying expectancy, stimulus registration and feature extraction, response preparation and execution, and updating to feedback about response accuracy. These results suggest that it is possible to characterize functional interdependencies of event-related processing between local neural areas by measuring the wave congruence and lag time of appropriately preprocessed low-frequency brain waves. Determining the distributed functional network of specialized areas of the brain producing the observed patterns is a formidable problem which is being attacked on a number of fronts. Author

N88-27687# New York Univ. Medical Center. Brain Research Labs.

NORMATIVE DEVELOPMENTAL EQUATIONS FOR THE EEG AND THEIR SENSITIVITY TO NEUROLOGICAL AND PSYCHIATRIC DISORDERS

E. R. JOHN and L. S. PRICHEP *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 7 p Feb. 1988 Prepared in cooperation with Kline (Nathan S.) Inst. for Psychiatric Research, Orangeburg, N.Y. Original contains color illustrations

Avail: NTIS HC A18/MF A01

Although the electroencephalogram (EEG) is altered by many brain dysfunctions, its clinical utility is severely limited by reliance upon visual pattern recognition and subjective interpretation. The goal was to not only replace subjective judgments by objective quantification, but to extend the utility of electrophysiological examinations beyond their traditional role in the detection of neurological disorders to the assessment of cognitive impairments and the evaluation of psychiatric patients. The initial studies were focussed on the problem of learning disabilities in children. As the techniques evolves, they were applied successfully to the assessment of pediatric neurological patients, to adult patients with mild head injury, cerebrovascular disease including transient ischemic attacks, alcoholism, cognitve impairment due to senile dementia, affective disorders, and psychoses. The method which was developed for these purposes, called neurometrics, is based upon the computerized extraction of a wide variety of objective indices of brain function as reflected in electrophysiological activity, the multivariate statistical evaluation of these quantitive measures, and the display of diagnostically significant findings in color coded topographic maps easily interpretable by the clinician without extensive specialized training. Author

N88-27688# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

THE APPLICATION OF NON-STATIONARY DATA ANALYSIS TECHNIQUES IN THE IDENTIFICATION OF CHANGES IN THE ELECTROENCEPHALOGRAM ASSOCIATED WITH THE ONSET OF DROWSINESS

NICOLA A. WRIGHT, R. G. BORLAND, and AMANDA MCGOWN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 5 p Feb. 1988

Avail: NTIS HC A18/MF A01

The electrical activity of the brain was analyzed using techniques to detect the occurrence of non-stationarities associated with transitional states between alert wakefulness and sleep. Eight minutes of resting eyes closed data were used in the analysis. A visual inspection was performed to classify the record into epochs of varying lengths according to the different states of arousal. Three states were defined: alert wakefulness, drowsy sleep, and a transitional state. Nonstationary data analysis techniques were used to identify these changes automatically. The techniques used were autoregressive modeling, in which the prediction error was used as a criterion to detect change, and evolutionary power spectrum analysis, where a spectral ratio was defined to detect differences between short epochs of the signal. In addition, the autocorrelation function was calculated for a limited number of lags, and changes in the function with reference to previous epochs used to identify the onset of change. These techniques were compared with methods of analysis based on a pre-defined epoch length, to determine the most efficient method of detecting changes associated with the transition between alertness and drowsiness. A discriminant function was calculated for each of the three visually classified states to define a classification rule, which was then used to allocate the segments produced by each of the automatic analysis techniques to one of the three states of alertness. Finally, the performance of each technique was assessed in terms of its ability to correctly classify segments of data. Author

N88-27689# National Hospital, Oslo (Norway). Lab. for Clinical Neurophysiology.

A STATISTICAL PROCEDURE FOR THE EVALUATION OF PRESENCE/NON-PRESENCE OF STIMULUS-RELATED EEG ACTIVITY

NILS IRGENS BACHEN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 9 p Feb. 1988

Avail: NTIS HC A18/MF A01

Averaging of a sufficient number of stimulus-related sample functions is a commonly applied method for the demonstration of evoked activity in the electroencephalogram (EEG). However, problems may arise in the visual evaluation of averaged waveforms when the signal-to-noise ratio is low, such as for instance in certain cerebral disease conditions, or when the intensity of the stimuli is low. In such situations the question of presence or not of evoked activity may be of material importance. Even experienced observers will find it difficult to give a reliable answer if their judgment has to depend only on visual assessment of the averaged waveforms obtained. A statistical test for the presence of evoked activity may be a guide to the correct decision in such cases. A statistical procedure based on phase value measurements of Fourier component in the post stimulus sample functions is presented. The distribution of these phase values is uniform in the interval 0 to 360 degree when the EEG sample functions contain no evoked activity. On the other hand, an aggregation of phase values in a certain angular region and hence a nonuniform distribution is to be expected if evoked activity is present. A statistical procedure testing a null hypothesis assumption of uniformity may thus be applied in the evaluation of presence/nonpresence of stimulus-related activity in the critical situations. A test of the Kolmogorov-Smirnov type, Kuiper's V(sub n) test, was applied with satisfactory results. Author

N88-27690# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Ophthalmology.

DISSECTING THE VISUAL AND AUDITORY PATHWAYS BY MEANS OF THE TWO-INPUT TECHNIQUE

D. REGAN and M. P. REGAN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 9 p Feb. 1988 Sponsored by the National Sciences and Engineering Research Council, Canada, MRC, Canada and AFOSR, Washington, D.C.

Avail: NTIS HC A18/MF A01

An evoked potential for identifying the nonlinear characteristics of specialized sensory neural mechanisms in the human brain is described. For example, subjects viewed a grating pattern modulated at F(sub 1) Hz superimposed on a second grating modulated at F(sub 2) Hz. The VEP consisted of about 20 discrete frequency components, each of less than 0.004 Hz bandwidth. Most would be destroyed by conventional averaging, but could be measured by zoom-FTT technique that gives 25,000 resolvable bins over DC-100 Hz. A mathematical treatment was developed such that the pattern of behavior among these VEP components fingerprints the nonlinear processing. Orientation tuning bandwidths (20 deg) and the spatial frequency tuning of a phase-independent visual mechanism; strong interactions between response to orthogonal orientations; and a possible EP means of investigating the auditory hair cell transducer characteristic are reported. Author

N88-27691# Consiglio Nazionale delle Ricerche, Rome (Italy). Istituto de Elettronica dello Stato Solido.

SQUID INSTRUMENTATION FOR NEUROMAGNETIC STUDY OF COMPLEX BRAIN ACTIVITY

GIAN LUCA ROMANI *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 7 p Feb. 1988

Avail: NTIS HC A18/MF A01

The impressive results obtained during the last few years by applying the neuromagnetic method to the investigation of brain physiology and pathology have given an extraordinary impulse to the development of large multi-sensor systems, which should

permit, in a relatively near future, to simultaneously detect the distribution of the magnetic field over a large area of the scalp and to achieve a real time functional localization of active cerebral sources. An outline of the main instrumental problems in the choice of an optimal sensor configuration (for large mutlichannel systems) is presented, with particular emphasis on the capability featured by different kinds of superconducting gradiometers to identify complex cerebral sources, and on the need for more sophisticated model sources. Author

N88-27692# Consiglio Nazionale delle Ricerche, Rome (Italy). Istituto di Elettronica dello Stato Solido.

ELECTRIC AND MAGNETIC BRAIN ACTIVITY RELATED TO COGNITIVE PERFORMANCE

ROBERT M. CHAPMAN, IVO MODENA, LIVIO MARICI, VITTORIO PIZZELLA, GIAN LUCA ROMANI, CARLO SALUSTRI, JOHN W. MCCRARY, and SUSAN GARNSEY (Rochester Univ., N. Y.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 8 p Feb. 1988

(Contract MH40703; HD22271; EY01319)

Avail: NTIS HC A18/MF A01

Cognitive performance and brain activity; memory storage component in evoked potentials; connotative meaning; and syntactic differences in words and linguistic processing were examined. B.G.

N88-27693# Muenster Univ. (West Germany). Inst. of Experimental Audiology.

NEUROMAGNETIC EVIDENCE OF PLACE MECHANISMS FOR *FREQUENCY AND INTENSITY* CODING IN THE HUMAN AUDITORY CORTEX

M. HOKE, C. PANTEW, K. LEHNERTZ, and B. LUETKENHOENER *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 12 p Feb. 1988 Sponsored by Deutsche Forschungsgemeinschaft, West Germany and Heinrich-Hertz-Stiftung, West Germany

Avail: NTIS HC A18/MF A01

The influence of two decisive parameters of the acoustic stimulus (frequency and intensity) on the auditory evoked magnetic field in response to tone-burst stimulation was investigated in four normal-hearing subjects. The influence was quantified in terms of changes of the parameters of an equivalent current dipole (spatial coordinates, direction, and strength). The frequency dependence was investigated by varying the carrier frequency of the tone-burst between 250 and 4000 Hz in octave steps with the intensity kept constant at 60 dB HL, while the intensity dependence was investigated by varying the intensity of a 1000 Hz tone-burst between 30 and 80 dB HL in 10 dB steps. The parameters of an equivanlent current dipole (ECD) were determined such that a maximum correspondence between observed and calculated field distribution (semi-infinite volume model) was obtained. The main results are as follows: the location of the ECD changes significantly as a function of test frequency and intensity. Especially the depth increases with the logarithm of test frequency which proves that also in humans the tonotopic organization of the cochlea is maintained in the auditory cortex. The decrease in depth of the ECD with increasing stimulus intensity supports the hypothesis that place mechanisms also play a role for intensity coding. Author

N88-27694# Simon Fraser Univ., Burnaby (British Columbia). Brain Behaviour Lab.

THE INTERACTION OF THALAMO-CORTICAL SYSTEMS IN THE 40 HZ FOLLOWING RESPONSE

H. WEINBERG, D. CHEYNE, P. BRICKETT, R. GORDON, and R. HARROP *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 6 p Feb. 1988

Avail: NTIS HC A18/MF A01

The study reported is an extension of the initial auditory experiments to include the study of 40 Hz vibration of glaborous skin receptors and examination of the interaction of simultaneous (in phase) auditory and tactile simulation. The data presented suggest that different systems are active in response to 40 Hz tactile vibration and auditory stimulation, although the EEG response at the vertex remains quite similar. B.G.

N88-27695# Simon Fraser Univ., Burnaby (British Columbia). Brain Behaviour Lab.

A STUDY OF SOURCES IN THE HUMAN BRAIN ASSOCIATED WITH STEREOPSIS

H. WEINBERG, P. BRICKETT, A. ROBERTSON, D. CRISP, D. CHEYNE, and R. HARROP *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 6 p Feb. 1988 Sponsored by the Defence and Civil Inst. of Environmental Medicine, Canada

Avail: NTIS HC A18/MF A01

The purpose of the initial stage of the research was to confirm with myoelectrography (MEG) the evidence for multiple stages of processing binocular information, establish what these stages are, and estimate location of generators. Initial experiments are designed to compare the magnetic fields evoked by dynamic random-dot stereograms (DRDSs) and dynamic RDCs in the same subject to see if the DRDC evoked field is similar to the early component of the response to the DRDS. The continuation of these experiments is concerned with the later component of the evoked field and the nature and location of the estimated sources. Author

N88-27696*# Illinois Univ., Champaign. Dept. of Psychology.

EVENT-RELATED BRAIN POTENTIALS AS INDICES OF MENTAL WORKLOAD AND ATTENTIONAL ALLOCATION

ARTHUR F. KRAMER, EMANUEL DONCHIN, and CHRISTOPHER D. WICKENS *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 15 p Feb. 1988 Sponsored by NASA, Ames Research Center, Moffett Field, Calif.

(Contract F49620-79-C-0233)

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Over the past decade considerable strides were made in explicating the antecedant conditions necessary for the elicitation, and the modulation of the amplitude and latency, of a number of components of the event-related brain potential (ERP). The focus of this report is on P300. The degree to which the psychophysiological measures contribute to issues in two real-world domains (communication devices for the motor impaired and the assessment of mental workload of aircraft pilots) are examined. Author

N88-27697# York Univ., Downsview (Ontario). Dept. of Physical Education.

THE EFFECTS OF HYPOXIA ON P300 AND REACTION TIME

B. FOWLER, B. KELSO, J. P. LANDOLT, and G. PORLIER (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 7 p Feb. 1988

(Contract DCIEM-W7711-6-9019)

(DCIEM-87-RR-12) Avail: NTIS HC A18/MF A01

This experiment investigated the effects of three levels of arterial oxyhemoglobin saturation (SaO2 of 75, 70, and 65 percent) on reaction time (RT) and P300 latency and amplitude. Ten subjects responded to visually presented male or female names in an oddball paradigm with accuracy controlled at a high level. Hypoxia increased both RT and P300 latency in a dose-related manner and these variables were strongly correlated. Hypoxia did not influence P300 amplitude. The increase in P300 latency is interpreted as further evidence that hypoxia allows stimulus evaluation processes and that, under the right circumstances, P300 could be used to index the effects of hypoxia on performance. Author

N88-27699# Washington Univ., St. Louis, Mo. Behavior Research Lab.
COGNITIVE TASK DEMANDS AS REFLECTED IN PHYSIOLOGICAL MEASURES
JOHN A. STERN and LANCE O. BAUER (Oklahoma Univ., Oklahoma City.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 11 p Feb. 1988
(Contract F49620-83-C-0059)
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Three experiments are described in which cognitive demands were manipulated. The task was a modified Sternberg paradigm comprised of three task stimuli: the cue, providing information about the memory set, the memory set itself, and a test stimulus, a member of the memory set on half the trials. Among variables investigated were set size and nature of the stimulus material. Physiological measures included EEG event-related potentials (ERP) to the three stimuli (task-RSPs), ERPs to probe stimuli (probe-ERPs), and flashes irrelevant to performance. Three measures derived from the eye blink and one heart rate measure were used. Results demonstrated ERP changes related to task difficulty. Some involved the ERP to the memory stimulus and some, the prove ERP. Heart rate changes, some related to expectancy, others to task demands, were also obtained. Blink probability, duration and timing, all reflected stimulus expectancy and difficulty. These results suggest that work load, as well as attention, can be evaluated using physiological measures. Author

N88-27702# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
PSYCHOPHYSIOLOGICAL MEASURES OF DROWSINESS AS ESTIMATORS OF MENTAL FATIGUE AND PERFORMANCE DEGRADATION DURING SLEEP DEPRIVATION
R. A. PIGEAU, R. J. HESLEGRAVE, and R. G. ANGUS *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 16 p Feb. 1988
Avail: NTIS HC A18/MF A01

A methodology developed to measure drowsiness electrophysiologically as an index of chronic fatigue experienced during periods of sleep loss is described. Nine volunteers performed a continuous cognitive workload schedule with 15 minute breaks occurring every 2 hours throughout a 64 hour sleep deprivation experiment. To measure fatigue a 4 minute eyes closed relaxation period was embedded once every hour within a battery of cognitive tasks. The subjects were instructed to relax with their eyes closed but remain awake and alert. The EEG signals collected during these periods were both visually scored and computer quantified. Two raters visually scored the signals for: time of first stage 1 sleep onset, number of stage 1 sleep onsets, shortest and longest time in stage 1, and total amount of state 1 sleep (or deepest). Period analysis was performed on the digitized data and a drowsiness scale was developed by subtracting the amount of theta and delta from alpha while controlling for individual differences by dividing the results by alpha minus theta minus delta activity present in the baseline. The results indicate that for individual subjects drowsiness onset latencies, performance, subjective scales, and the drowsiness index are all intercorrelated. It is suggested that these EEG techniques, as well as the methodology of embedding eyes close relaxation periods, yield sensitive measures for detecting differential levels of drowsiness during sleep deprivation. Author

N88-27703# EEG Systems Lab., San Francisco, Calif.
NEUROPHYSIOLOGICAL PATTERNS OF OPERATIONAL FATIGUE: PRELIMINARY RESULTS
A. S. GEVINS, B. A. CUTILLO, R. M. FOWLER-WHITE, J. ILLES, S. L. BRESSLER, and J. C. MILLER (Test Group, 6520th, Edwards AFB, Calif) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 9 p Feb. 1988 Sponsored by AFOSR, Washington, D.C., School of Aerospace Medicine, Brooks, AFB, Tex., National Inst. of Neurological and Communicative Diseases and Strokes, Washington, D.C. and NSF, Washington, D.C. Original contains color illustrations
Avail: NTIS HC A18/MF A01

Impaired behavior consequent to prolonged mental work is commonly attributed to the effects of fatigue on higher cognitive functions rather than to changes in rote perceptuomotor or motor functions. A deeper understanding of these effects awaits better knowledge of the underlying neurophysiological mechanisms. Here a modes contribution is made toward this end with a study of event-related, spatiotemporal neuroelectric patterns of five U.S. Air Force test pilots performing a high-load visuomotor monitoring task while alert, becoming fatigued, and fully fatigued. The preliminary results suggest that although neural systems responsible for primary visual stimulus processing remain relatively unaffected, cortical associative areas implicated in task-specific response inhibition are affected even during early stages of fatigue. With further research, it may be possible to design on-line devices for predicting transient cognitive lapses and performance decrements resulting from operational fatigue. Author

N88-27705# Burden Neurological Inst., Bristol (England).
EVENT-RELATED AND STEADY POTENTIAL CHANGES IN THE BRAIN RELATED TO WORKLOAD DURING TRACKING
W. C. MCCALLUM, R. COOPER, and P. V. POCOCK *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 10 p Feb. 1988 Sponsored by British Aerospace, United Kingdom and the Ministry of Defence, United Kingdom
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In two experiments event-related potentials (ERPs) and slow potential changes were recorded from normal subjects performing a visual tracking in which the level of difficulty was systematically varied. In the second experiment a secondary discrimination task was added to increase the level of operator load and to probe the allocation of cerebral processing resources. The most notable feature to emerge was a protracted slow potential shift, associated with the primary task. The amplitude of this shift proved to be sensitive to the difficulty manipulations such that increased difficulty resulted in increased negativity. However, a memory task introduced in the early part of each trial tended progressively to decrease the amplitude of the shift as the memory demand increased. The ERPs to the individual points of decision and response during the course of a trial were also found to be sensitive to the level of task loading. The introduction of the secondary task resulted in a possible further increase in the negative shift to tracking, but in reductions in the amplitude of late cognition components of the secondary task ERPs compared with their levels when this task was presented on its own. Author

N88-27706# EEG Systems Lab., San Francisco, Calif.
NEUROPHYSIOLOGICAL PRECURSORS OF ACCURATE VISUOMOTOR PERFORMANCE
A. S. GEVINS, B. A. CUTILLO, S. L. BRESSLER, N. H. MORGAN, R. M. FOWLER-WHITE, D. S. GREER, J. ILLES, J. C. DOYLE, R. S. TANNEHILL, and G. M. ZEITLIN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 11 p Feb. 1988 Sponsored by AFOSR, Washington, D.C., School of Aerospace Medicine, Brooks, AFB, Tex., NSF, Washington, D.C., National Inst. of Neurological Diseases and Strokes, Washington, D.C. and ONR, Washington, D.C. Original contains color illustrations
Avail: NTIS HC A18/MF A01

Using advanced, signal processing techniques, the rapidly changing, spatial mass neuroelectric patterns associated with preparation and execution of precise right- and left-hand finger pressures in response to visual numeric stimuli in seven healthy right-handed adult male subjects were measured. Previously unseen pre-stimulus differences between patterns associated with subsequently accurate and inaccurate performance were revealed. A spatially specific, multi-component neural preparatory set, composed of invariant left frontal and midline precentral components and hand-specific central and posterior parietal

components, appear to be essential for accurate performance of certain types of difficult visuomotor tasks. When this preparatory set is weakened, or inappropriate, subsequent performance is likely to be inaccurate. Author

N88-27708# Naval Biodynamics Lab., New Orleans, La. Impact Sciences Dept.
EVOKED POTENTIAL ANALYSIS OF IMPACT ACCELERATION EXPERIMENTS
DAVID L. MATSON and MARC S. WEISS *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 13 p Feb. 1988
Avail: NTIS HC A18/MF A01

The use of somatosensory evoked potentials (SEPs) as an assessment tool for transient injury in rhesus macaques undergoing impact acceleration in the -Gx direction is examined. Adult male rhesus macaques, seated on a sled and restrained (except for the head and neck), were accelerated at peak sled accelerations ranging from 95.5 to 1039.6 m/sec squared. The sled was decelerated by friction forces ranging from 0.7 to 3.0 m/sec squared. Somatosensory stimuli were delivered prior to, during, and after impact. Amplified SEP activity was telemetered and recorded on magnetic tape. The raw SEP data were digitized and analyzed off-line. Results for cortical SEPs are consistent with and extend previous analyses, suggesting a threshold for transitory changes in cervical SEP latencies in macaques at peak -Gx sled accelerations below 550 m/sec squared. This threshold is below the threshold for single impact -Gx neuropathological injury in macaques (800 m/sec squared), and suggests a role for cortical SEPs in establishing injury critieria for humans. Author

N88-27709# School of Aerospace Medicine, Brooks AFB, Tex.
EEG INDICES OF G-INDUCED LOSS OF CONSCIOUSNESS (G-LOC)
NITA L. LEWIS, JENNIFER B. MCGOVERN, JAMES C. MILLER, DOUGLAS R. EDDY, and ESTRELLA M. FORSTER (Rothe Development, San Antonio, Tex.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 12 p Feb. 1988
Avail: NTIS HC A18/MF A01

To investigate the utility of the electroencephalogram (EEG) as an indicator of state of consciousness, human brain activity was recorded during exposure to rapid onset (6 G/sec) centrifugation (+7G). Eight healthy volunteers were given at least two sessions of sustained acceleration on the USAFSAM human centrifuge. The sessions were conducted without G-suits and subjects were instructed to relax and not attempt anti-G straining maneuvers. Six subjects each experienced two episodes of G-induced loss of consciousness (G-LOC) while one subject lost consciousness once and experienced visual blackout once. One subject remained conscious but experienced visual grayout in both sessions. The EEG signals were recorded with EEG Grass gold-cup electrodes which were held in place by using gauze and collodion. Data were digitized at 256 samples per second and transferred to a DEC PDP-11/55 computer for analysis. Results demonstrated a shift from beta to delta activity with pronounced absence of beta activity during unconsciousness. These results are in keeping with findings in the anesthesia and aerospace medicine literature. The EEG can be useful in detecting unconsciousness during acceleration. Author

N88-27710# Naval Air Development Center, Warminster, Pa.
DETECTION OF ACCELERATION (+GZ) INDUCED BLACKOUT BY MATCHED-FILTERING OF VISUAL EVOKED POTENTIALS
JOHN G. NELSON, JOSEPH P. CAMMAROTA, and LEONID HREBIEN *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 13 p Feb. 1988
Avail: NTIS HC A18/MF A01

In air-combat-maneuvering and on human centrifuges, moderate levels of positive acceleration (+Gz), coupled with moderate rates of onset, produce visual symptoms which are ordinarily progressive: decreasing visual sensitivity, dimming of visual field, peripheral light-loss, and central light-loss of consciousness, subjective visual symptoms are the most commonly used tolerance end point in acceleration research. In order to provide an objective indication of the integrity of the visual system, a method for real-time monitoring of the steady-state visual evoked potential (VEP) was developed. Using the Fast Fourier Transform (FFT), a method for maximizing the signal-to-noise ratios was developed: a digital, frequency domain, non-white-noise matched filter, with evaluation only at the expected response peak. Experiments on the U.S. Naval Development Center's Human Centrifuge demonstrated that the response does progressively decrease, disappearing at black-out. Improved computer facilities have permitted evaluation of alternative methods of processing, and the effectiveness of such processing. Data from a static experiment using four stimulus repetition rates and two electrode positions showed that windowing of the time record prior to FFT does not necessarily improve detection. Author

N88-27712# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MOTION EVOKED VESTIBULAR POTENTIALS
G. WILSON, R. LUCIANI, and D. RATINO (Air Force Human Resources Lab., Williams AFB, Ariz.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 5 p Feb. 1988
Avail: NTIS HC A18/MF A01

Motion evoked potentials (MER) were collected from subjects while they were rotated from side to side in a seated position. The MERs were biphasic with major component mean latencies of 278 and 388 msec. It is concluded that the MERs are of brain origin and not due to artifacts from the recording environment. The latencies of the waveform components of the MER suggests that the MER results from the onset of the rotation stimulus. Differences between the MERs reported and those of other published reports may be due to the added involvement of the saccule/utricle apparatus and the more rapid onset of the stimulus. Author

N88-27713# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE EFFECT OF MILD HYPOXIA ON THE VESTIBULAR EVOKED RESPONSE
W. D. FRASER, N. BLACK, D. E. EASTMAN, and J. P. LANDOLT *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 10 p Feb. 1988
Avail: NTIS HC A18/MF A01

The effect of hypoxia on the long-term vestibular evoked response was examined in eight sitting subjects on a small target light that rotated with the subject. Evoked responses were recorded during 10 minutes of rotational stimulation after breathing each gas mixture for a minimum of 25 minutes. For intermittent clockwise (CW) rotation in the horizontal plane, a reproducible negative potential developed at electrode sites located between the vertex and the linked ears during air breathing conditions. It peaked close to the point of maximum velocity of the sinusoidal stimulus. The results indicate that the cortical processing of vestibular sensations may be affected even under very mildly phyoxic conditions. Animal studies have indicated that the levels of hypoxia used in this study can significantly alter neurotransmitter metabolism in brain tissue. Modification in neurotransmitter synthesis and concentration by the hypoxic conditions may explain the susceptibility of cortical processing of sensory information to very mild hypoxia. Compensatory changes in cerebral blood flow and neurotransmitter synthesis may be responsible for the reduced effect under the more severe hypoxic conditions. Author

N88-27714# Hordt Research, Development and Therapy, Rodgau (West Germany).
MEASUREMENT AND CLASSIFICATION OF THE MODE OF ACTION OF ANTIDEPRESSANT DRUGS
ALBRECHT FRAUENDORF, DAVID JOHNSON, and LOTHAR

DEMISCH (Johann-Wolfgang-Goethe-Univ., Frankfurt am Main, West Germany) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 9 p Feb. 1988
Avail: NTIS HC A18/MF A01

In a comparison of the chronic effects on the central nervous system of five new generation antidepresssant, a dose-response study was performed with 5 to 7 healthy subjects per substance. Following standard medical screening, intraindividual comparisons after one week at each of the three dosages. Two MAO-inhibitors, a NA-reuptake inhibitor, a serotonine-reuptake inhibitor, and an alpha 1/alpha 2 adrenergic receptor, and serotonine S sub 2 (receptor-antagonist). The visual evoked potentials were recorded from electrode position O sub z between O sub 1 and O sub 2. The brightness, contract, and color channels of the visual system were stimulated using on-off, checkerboard, and color changes respectively. After digitizing, the evoked potentials were subjected to Fourier filtering and analyzed in the standard EEG frequency ranges delta, theta, alpha, and beta. This improved stability and precision of measurement without phase shifts. The latency changes of all components were measured and used to form attenuation and activation coefficients in each range. With the help of factor analysis, an activity profile of the effects of each of these drugs in the CNS was plotted in three-dimensions. Both activation and attenuation coefficients were used to classify the effects of the antidepressants at the cortical level. Author

N88-27715# Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (West Germany).
MEASUREMENT OF ELECTRICAL ACTIVITY IN THE CNS WITH CORTICAL EVOKED POTENTIALS AND EEG: EFFICACY PROFILES OF DRUGS USING FACTOR ANALYSIS
DAVID JOHNSON, ALBRECHT FRAUENDORF (Hordt Research, Development and Therapy, Rodgau, West Germany), and KURT OFFENLOCH *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 8 p Feb. 1988
Avail: NTIS HC A18/MF A01

In a series of experiments with 20 healthy, subjects per substance, the influences of a new nootropic drug and three cardiovascular agents on the CNS were measured and placebo controlled. The EEG and visual cortical evoked potentials were recorded from electrode position O sub z between O sub 1 and O sub 2 according to the 10 to 20 system. Three channels of the visual system were selectively stimulated (contrast, brightness, and color using checkerboard, flash, and color change). Acute and chronic studies were reported. Each VEP was filtered into the standard EEG-frequency range. Latency changes of the EP were evaluated in each range and analyzed with the Fourier technique. The cardiovascular substances caused a significant latency increase of beta-components with apparent latencies of 80 to 100 ms. This attenuation was shown in the contrast and even stronger in the color channel of the visual system. For the nootropic substance, a significant latency decrease was found for three components of the visual evoked potential in the theta-range. Their latencies are from 170 to 360 ms. The results of the EEG analysis are compared to the EP results. Generalized changes for groups of substances and highly specific profiles of activity for individual substances may be measured using this set of stimulus and analysis techniques. Activation and attenuation of activity for one and the same substances also were measured indicating multiple modes of actions. This may reflect cognitive processes and sensomotor activity. Author

N88-27716# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France). Div. de Neurophysiologie Appliquee.
AN APPROACH TO STUDYING THE EFFECTS OF PSYCHOSTIMULANTS ON CEREBRAL ELECTRICAL ACTIVITY IN THE NON-HUMAN PRIMATE [UNE APPROCHE DES EFFETS DE PSYCHOSTIMULANTS SUR L'ACTIVITE ELECTRIQUE CEREBRALE CHEZ LE PRIMATE NON HUMAIN]
D. LAGARDE and C. MILHAUD *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 11 p Feb. 1988 In FRENCH
Avail: NTIS HC A18/MF A01

The effects of three psychostimulant substances on brain electrical activity in the rhesus monkey were studied. The prime objective of these experiments was to obtain a data base of EEG properties and the changes caused by well-known psychostimulants at different dosages, and compare them to the EEG modifications induced by experimental psychotropic drugs. The power spectral density was used to analyze EEG data into different frequency bands for caffeine, d-amphetamine sulfate, and the experimental drug CRL 40476. In general, the results showed that caffeine caused a significant increase in delta activity, some decrease in the theta and alpha bands, and variable decreases in the beta band. Amphetamine produced an increase in delta and alpha activities, relative stability with signs towards an increase in theta activity, and a clear decrease in beta activity. The CRL 40476 caused important increases in delta activity, no changes in theta and alpha activity, and some decrease in the level of beta activity. Author

N88-27717# Italian Air Force Aerospace Medical Center, Rome. Neuropsychophysiology Group.
SPONTANEOUS CEREBRAL ELECTRICAL ACTIVITY DURING PROLONGED HYPOGLYCEMIA: A QUANTITATIVE STUDY IN HUMANS
SILVIO PORCU, ROBERTO BERTI, and ALBERTO LALA *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 12 p Feb. 1988
Avail: NTIS HC A18/MF A01

The importance of neuroglycopenia secondary to hypoglycemia as a possible cause or contributing factor in aircraft accidents was stressed. The study was designed to investigate the neurophysiological correlations of neuroglycopenia. The generation of spontaneous cerebral electrical activity in healthy young adults is quantified in a computer-assisted study, with subjects placed under fixed hypoglycemic conditions. Author

N88-27718# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Ophthalmology.
RELATION BETWEEN VEP AND VISUAL FUNCTION IN LESIONS OF THE OPTIC NERVE AND VISUAL PATHWAY
D. REGAN and D. NEIMS *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 8 p Feb. 1988 Sponsored in part by Medical Research Council of Canada, Multiple Sclerosis Society of Canada, Baker Trust of Canada and NIH, Bethesda, Md.
Avail: NTIS HC A18/MF A01

Several authors have claimed that visual evoked potential (VEP) abnormality is not closely related to sensory visual loss in patients with multiple sclerosis. However, all of the studies assessed sensory visual loss entirely in terms of Snellen visual acuity. Recent findings indicate the possibility that this lack of correlation between VEPs and sensory data might be due, at least in part, to the inability of Snellen's test to detect the full range of visual losses associated with visual pathway dysfunction. Before discussing abnormalities of pattern VEPs in patients with demyelinating diseases, the reasons why the Snellen acuity provides only an incomplete test of visual function loss are explained. Author

N88-27720# Royal Air Force, Wroughton (England). Neurology Dept.
DETECTION OF LATENT EPILEPSY IN AIRCREW CANDIDATES
R. T. G. MERRY *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 3 p Feb. 1988
Avail: NTIS HC A18/MF A01

Epilepsy is a common medical disorder, with a prevalence of 0.5 to 0.8 percent, and is the commonest cause of accidents due to medical incapacity in drivers. Although imperfect, the

electroencephalogram (EEG) is useful in the detection of a latent predisposition to epilepsy, and is recommended as an obligatory part of the initial medical examination of candidates for military aircrew. Author

N88-27721# Oficinas Gerais de Material Aeronautico, Alverca (Portugal).
THE AUDITORY EVOKED RESPONSE IN MILITARY PILOTS
NUNO A. A. CASTELOBRANCO, JOSE H. MARVAO, M. SALOME CASTELOBRANCO, and ANTONIO J. ENTRUDO (Portugal Air Force Hospital.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 8 p Feb. 1988
Avail: NTIS HC A18/MF A01

This study relates to the effect of G forces, through an aerobatic flight profile without G suit protection, upon twenty military pilots with varying flight experience. The auditory evoked response during rest showed significant differences in wave 5 and in the 1 to 5 interval. Immediately following the flight, differences were observed in wave 3. These results suggest the importance which this electrophysiological method may have on measuring accumulated fatigue. Immediate fatigue implies complex mathematical problems presently under study. Simultaneously, hemorrheologic, hormonal and biochemical studies were conducted for a better understanding of the physiological effects of fatigue. Though it is recognized that the test population is relatively small (20 pilots), an expanded study is underway in order to compile more conclusive data. Author

N88-27726# National Inst. of Health, Bethesda, Md. National Eye Inst.
VISION RESEARCH. A NATIONAL PLAN: 1983-1987, 1987 EVALUATION AND UPDATE Final Report, Oct. 1984 - Dec. 1986
1987 334 p
(PB88-192604; NIH/PUB-87-2755) Avail: NTIS HC A15/MF A01 CSCL 06P

The evaluation project examined the current level and distribution of effort in all the scientific research areas addressed by Vision Research-A National Plant: 1983-1987, the National Advisory eye Council's most resecent planning and evaluation document. It recognized and encouraged activity in important new ares that had developed since the Plan was prepared. It identified recommendations that were not sufficiently specific or those that were prematrue or too narrow in focus and might have benefitted from consolidation with other recommendations. A computerized system was developed and used to track grant applications wherin every grant application, whether funded or not, was coded according to the relevance to one of the Plan's recommendations. The report produced by this effort was used by the National Advisory Eye Council and the staff of the NEI to determine long-range and day-to-day management decisions, by scientists in the vision research community as a guide to most important needs and opportunity as a guide to the most important needs and opportunities in the field; and by organizations, foundations, all those interested in recent problems and challenges in ophthalmology, optometry, and vision science, including current activites and plans for continued success in the prevention, treatment, and control of blinding disease. GRA

N88-27727# Army Research Inst. of Environmental Medicine, Natick, Mass.
HYPOTHALAMIC-PITUITARY-ADRENAL RESPONSES TO SHORT DURATION HIGH INTENSITY CYCLE EXERCISE
WILLIAM J. KRAEMER, JOHN F. PATTON, HOWARD G. KNUTTGEN, LOUIS J. MARCHITELLI, and CHARLES CRUTHIRDS Jan. 1988 32 p
(AD-A192597; USARIEM-M-16/88) Avail: NTIS HC A03/MF A01 CSCL 06A

Beta-endorphin (B-EP), adrenocorticotropin (ACTH) and cortisol plasma concentrations were examined before and after maximal exercise at four intensities (36, 55, 73 and 100 percent of Maximal Leg Power (MLP) utilizing a computerized cycle ergometer. All intensities were greater than those eliciting peak oxygen uptake for the individual subjects. Blood samples were collected at rest, immediately following exercise (IP) and at 5 and 15 min post-exercise. Significant (p less than 0.05) increases were observed at 36 percent MLP for B-EP and ACTH at IP, 5 and 15 min post-exercise. Plasma cortisol increased at 36 percent MLP at 15 min post exercise. Blood lactate significantly increased at all post-exercise collection points for exercise intensities of 36, 55 and 73 percent MLP and at 5 min post exercise for 100 percent MLP. B-EP concentrations at 36 percent MLP were significantly correlated ($r=0.75$) with capillary density (mm-2) and cortisol concentrations at 36 percent MLP were significantly correlated ($r=0.89$) with percent type 2 muscle fibers. No other significant relationships were observed. GRA

N88-27728# Army Research Inst. of Environmental Medicine, Natick, Mass.
METABOLIC AND CARDIORESPIRATORY PARAMETERS DURING THREE CONSECUTIVE DAYS OF EXHAUSTIVE RUNNING Report, Feb. - Mar. 1982
JOSEPH KNAPIK, JAMES WRIGHT, MICHAEL WELCH, MARILYN SHARP, and ROBERT MELLO Nov. 1987 22 p
(AD-A192598; USARIEM-M-10/88) Avail: NTIS HC A03/MF A01 CSCL 06D

Serum metabolites, cardiorespiratory parameters and creatine kinase were examined during running on 3 consecutive days. Thirteen trained marathon runners exercised to exhaustion on a treadmill at 85 plus or minus 3 percent VO2 max on each day. Expired gases and blood samples were obtained at rest, after 10 and 30 min of exercise and at exhaustion. There were no significant differences over days for glucose, insulin, lactate, free fatty acids, creatine kinase, oxygen uptake, minute ventilation, heart rate, rating of perceived exertion, respiratory exchange ratio or run times. Serum glycerol was elevated (p .05) both at rest and during exercise on each successive day. The findings suggested that except for serum glycerol, acute metabolic and cardiorespiratory responses to exhaustive aerobic exercise are not altered by daily repetition at least up to 3 days. GRA

N88-27729# Army Research Inst. of Environmental Medicine, Natick, Mass.
VALIDATION OF A MODIFIED ONE-STEP REBREATHING TECHNIQUE FOR MEASURING EXERCISE CARDIAC OUTPUT Final Report, Jan. - Dec. 1987
PATRICIA C. SZLYK, KARLEYTON C. EVANS, and INGRID V. SILS 19 Jan. 1988 22 p
(AD-A192600; USARIEM-M-19/88) Avail: NTIS HC A03/MF A01 CSCL 05H

A modification of the Farhi one-step rebreathing technique is described for determining submaximal exercise cardiac output (Q). Factors critical in the estimation of Q are initial rebreathing bag volume and constant bag volume during the maneuver. By substituting a high flow rate analyzer for the recommended low flow rate mass spectrometer, adding a recirculation circuit from the outlet of the analyzer to an inlet at the base of the rebreathing bag and reducing the length of sample tubing to the analyzer, we were able to recirculate the subject's expired gas and achieve no loss of bag volume. No statistically significant differences in estimate of cardiac output were noted between the mass spectrometer and LB-2 analyzer with recirculation circuit during submaximal cycling. Heart rate and oxygen uptake were highly correlated with cardiac output and agreed well with the literature, irrespective of the CO2 analyzer system used. A unique feature of our method is that the subject's tidal volume is measured prior to the maneuver and then used as the initial rebreathing bag volume. Varying the bag volume by + or - 0.2L from the tidal volume had no significant effect on the estimate of cardiac output during exercise. Now quick, reliable and noninvasive measurements of cardiac output are feasible in subjects not only in the laboratory but also in the field where a mass spectrometer is not readily portable. GRA

N88-27730# Army Research Inst. of Environmental Medicine, Natick, Mass.
A RESISTIVE-FILM BASED FORCE TRANSDUCER FOR THE STUDY OF EXERCISE
PETER N. FRYKMAN, EVERETT A. HARMAN, RICHARD M. ROSENSTEIN, and STEPHEN P. MULLEN Jan. 1988 208 p
(AD-A192601; USARIEM-M-17/88) Avail: NTIS HC A10/MF A01 CSCL 14B

A new pressure sensitive resistive film was used to construct a pair of force sensing pedals designed to fit a Universal leg press machine. The sensors were calibrated by recording their output voltages on a microcomputer via an A/D converter sampling at 100 Hz as weight was placed on each pedal's top surface. Third order polynomial equations were fit to the data and resulted in correlation coefficients between actual and predicted force of .9965 for the right pedal and .9918 for the left. Within day reliability coefficients were .9997 and .9994 for the right and left pedals respectively, while across day reliability coefficients were .9989 and .9877. The upper limit of accurate force transduction is over 5000 N per pedal. The pedal transducer is reliable, valid, inexpensive, and relatively easy to work with. The resistance film requires considerably less engineering than do strain gages in the construction of transducers to measure forces applied to a flat surface. GRA

N88-27731# Army Research Inst. of Environmental Medicine, Natick, Mass.
HYPERTHERMIA: NEW THOUGHTS ON AN OLD PROBLEM
ROGER W. HUBBARD and LAWRENCE E. ARMSTRONG Dec. 1987 18 p
(AD-A192602; USARIEM-M-13/88) Avail: NTIS HC A03/MF A01 CSCL 06E

In this article, the common heat illnesses (heat syncope, salt-and water depletion-heat exhaustion and exertion-induced heatstroke) are briefly reviewed from the perspective of their underlying physiological disturbances, which provide a rational basis for therapy. Due to an apparent paradox between the current clinical dogma and laboratory data, however, the evaluation of the consequences of hyperthermia is extended beyond the usual systematic approach. What translates heat stress into heat strain and whether the mechanism is identifiable is studied. A new hypothesis, based upon experimental research, is offered which suggests that a series of factors operate in exercise-induced hyperthermia to increase the permeability of the cell membrane, primarily to sodium ions. This stimulates sodium-potassium ATPase (the Sodium Pump) and results in an inefficient energy drain upon the cell (the Energy Depletion Model). This concept takes the form of a vicious circle leading to increased heat production and storage, reduced exercise-heat tolerance and significant morbidity and mortality. This model predicts that cellular/metabolic processes and deficits operate for some time after hyperthermia has subsided with cooling. GRA

N88-27732# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL RESPONSES TO ACUTE EXERCISE-HEAT STRESS
MICHAEL N. SAWKA and C. B. WENGER Jan. 1988 103 p
(AD-A192606; USARIEM-M-14/88) Avail: NTIS HC A06/MF A01 CSCL 06J

Human body temperature is regulated by a proportionate control system. It is unclear however, which internal body temperature is regulated by the control of the thermoregulatory effector responses of skin blood flow and sweating. The core temperature increases during exercise as a result of a load error and not a change in the regulated set-point temperature. During exercise the magnitude of core temperature elevation at steady-state is proportional to the metabolic rate and is largely independent of the environmental condition. However, dependent upon the environmental conditions the relative contributions of sensible (radiative and convective) and insensible (evaporative) heat exchange to the total heat loss will vary. The hotter the environment the greater the dependence on insensible heat loss. During exercise in the heat, the primary problem is to simultaneously provide the cardiovascular support to maintain the metabolism for skeletal muscle contraction and to dissipate the associated heat release. In hot environments, the core to skin temperature gradient is reduced to skin blood flow needs to be relatively high (compared to cooler environments) to achieve heat transfer sufficient for thermal balance. In addition, sweat secretion can result in a reduced plasma (by dehydration) and thus blood volume. Both high skin blood flow and reduced plasma volume can reduce cardiac filling and perhaps cardiac output during exercise in the heat. As a result syncope or reduced exercise preformance will occur. GRA

N88-27733# Naval Health Research Center, San Diego, Calif.
BEHAVIORAL, PSYCHOLOGICAL AND DEMOGRAPHIC PREDICTORS OF PHYSICAL FITNESS Interim Report
TERRY L. CONWAY 14 Dec. 1987 21 p
(AD-A192697; NHRC-87-37) Avail: NTIS HC A03/MF A01 CSCL 06J

Achieving higher levels of physical fitness has become a goal of many Americans both for personal reasons (e.g., improved health, appearance, and perceived well-being) and for organizational reasons (e.g., corporate cost savings with healthy employees; operational readiness for the military services). Understanding the factors which relate to physical fitness could help people improve their fitness levels. This study examined 1,357 Navy men to determine the associations between a variety of behavioral, psychological, and background factors and four components of physical fitness: (1) cardiorespiratory endurance (1.5-mile run), (2) muscular endurance (sit-ups), (3) flexibility (sit-and-reach test), and (4) body composition (estimated percent body fat). After controlling for exercise activities, physical fitness was positively associated with wellness behaviors, believing in the importance of physical fitness, expecting to reach/maintain ideal weight, being athletic as a youth, and years of schooling; fitness was negatively associated with tobacco use, preventive/avoidance behaviors, age, and ever being overweight. Identifying such factors may help to structure better fitness programs tailored to the individual. GRA

N88-27734# Boston Univ., Mass. Center for Adaptive Systems.
THE VITE MODEL: A NEUTRAL COMMAND CIRCUIT FOR A GENERATING ARM AND ARTICULATOR TRAJECTORIES
STEPHEN GROSSBERG and DANIEL BULLOCK Mar. 1988 23 p
(Contract F49620-86-C-0037; NSF IRI-84-17756)
(AD-A192715; AFOSR-88-0384TR) Avail: NTIS HC A03/MF A01 CSCL 12I

A major issue in research on the neural basis of motor control is the nature of movement planning in systems with many degrees of freedom; for example, an arm with many controlling muscles acting at several joints or a speech system with many articulators. All solutions to the planning problem depend upon assumptions about both the mechanics of the effectors and the sensory and computational resources. For example, if an arm has few mechanical degrees of freedom, than the serial preplanning required to work around the arm's inherent constraints becomes a salient issue. Alternatively, if the arm has many degrees of freedom, the computational load imposed by the need for simultaneous coordination becomes a salient issue. If the arm is part of a body that grows, or if a robotic arm must remain in service without external maintenance despite unpredictable changes in its mechanical parameters, then yet another issue comes into view; autonomous recalibration. GRA

N88-27735# Army Research Inst. of Environmental Medicine, Natick, Mass.
VALIDATION OF A MODIFIED ONE-STEP REBREATHING TECHNIQUE FOR NON-INVASIVE MEASUREMENT OF SUBMAXIMAL CARDIAC OUTPUT Final Report, Jan. - Nov. 1987
PATRICIA C. SZLYK, KARLEYTON C. EVANS, and INGRID V. SILS Jan. 1988 47 p

(AD-A192852; USARIEM-T8-88) Avail: NTIS HC A03/MF A01 CSCL 06E

The primary objectives of this study were to modify the Farhi one-step carbon dioxide (CO2) rebreathing technique for measuring cardiac output during rest and submaximal exercise, and then to validate our modifications. The novelty of Farhi's technique is that it (1) requires only one-step to acquire all data necessary for computations, (2) is noninvasive, (3) takes less than 30 seconds for each rebreathing maneuver, (4) can be repeated at rapid intervals (1 to 2 minutes), and (5) is accurate and highly reproducible. Because a low flow rate analyzer (mass spectrometer) that Farhi specified as being essential for monitoring CO2 at the mouth during rebreathing was available to us only on a limited basis and is not readily field portable, we modified both available equipment and technique. GRA

N88-27736# Maryland Univ., College Park. Dept. of Electrical Engineering.

EFFECTS OF PULSED AND CW (CONTINUOUS WAVE) 2450 MHZ RADIATION ON TRANSFORMATION AND CHROMOSOMES OF HUMAN LYMPHOCYTES IN VITRO Progress Report, 1 Oct. 1986 - 1 Oct. 1987

CHRISTOPHER C. DAVIS 16 Feb. 1988 47 p

(Contract N00014-86-K-0716)

(AD-A193104) Avail: NTIS HC A03/MF A01 CSCL 06J

The main objective of this project is to determine conditions of exposure of human lymphocytes in vitro to continuous wave (CW) or pulsed wave (PW) 2450 MHz microwaves, which: affect the course of spontaneous or phytohemagglutin in (PHA)-induced lymphoblastoid transformation, and may induce numerical and/or structural aberrations in chromosomes of cells undergoing division following transformation. In order to provide reliable quantitative data on exposure, a system will automated dosimetry was developed, and tested for biocompatibility with lymphocyte cultures in vitro for periods of up to 120 hrs. (5 days). A method for quantitation of lymphocyte transformation based on image analysis was developed and tested. Experiments on effects of exposure on spontaneous transformation were carried out. For convenience and clarity the work performed is described under two separate headings: (1) exposure system and dosimetry, and (2) studies on lymphocyte cultures. GRA

N88-27737# Washington Univ., St. Louis, Mo. Dept. of Otolaryngology.

ASSESSMENT OF COCHLEAR DAMAGE AFTER MICROWAVE IRRADIATION Final Report, 30 Sep. 1985 - 17 Feb. 1988

BARBARA A. BOHNE, MARY M. GRUNER, and HOWARD I. BASSEN Feb. 1988 35 p

(Contract DAMD17-85-C-5321)

(AD-A193237; OTO-1-88) Avail: NTIS HC A03/MF A01 CSCL 06G

The objective of this project was to determine if excessive exposure to microwaves results in permanent damage to the inner ear. A group of 15 chinchillas was exposed for one hour to pulsed microwaves (1250 MHz) of 20 microsec duration and 0.1-Hz repetition rate and an average power of 1 Watt. The specific absorption rate of various measurement sites in the head ranged from 2 to 8 Wkg. The exposures were done at the WRAIR Microwave Laboratory, Washington, D.C. Seven animals were sham-exposed for one hour using the same apparatus and sedation. For the sham exposures, the microwave equipment was powered but no radiation was delivered. The cochleas from 20 control chinchillas of the same age range as the animals in the present study were available for comparison purposes. The controls had spent their entire lives in sound-treated animal quarters at Washington University in St. Louis, MO. The cochleas from all animals were processed for histological evaluation as plastic-embedded flat preparations. Some animals were processed less than 24 hour after their exposures; the rest were processed after a month or more of recovery. In each cochlea, the following quantitative data were obtained: the extent and pattern of degeneration in the sensory cell populations; the number of missing pillar cells; the extent and location of degeneration of the stria vascularis and of the myelinated nerve fibers in the osseous spiral lamina. GRA

N88-27738# School of Aerospace Medicine, Brooks AFB, Tex.

BEHAVIORAL EFFECTS OF EXPOSURE TO THE TEMPO HIGH-POWER MICROWAVE SYSTEM Interim Report, Jan. - Jun. 1987

B. J. KLAUENBERG, JAMES H. MERRITT, and DAVID N. ERWIN Mar. 1988 20 p

(AD-A193305; USAFSAM-TR-87-35) Avail: NTIS HC A03/MF A01 CSCL 06G

Safety standard for exposure to radiofrequency radiation must be based upon biologic consequences of exposure to such environments. Behavioral based measures are considered to be the most sensitive indices of biological effects. Current safety guidelines are based upon average power density and may not be relevant to the high peak power, short pulse width microwave radiation produced by newly developed high peak power microwave sources. The effects of exposure to high peak power radiation on reflexive responding and motor function in Fischer 344/N rats were assessed by measuring startle and general activity, and disruption of on-going performance of a rotarod task respectively. The emitter used was the TEMPO repeat pulse axially extracted vircator. Exposure to single pulses resulted in significant startle responses. Exposure to 1 pps for 10 s produced significant alterations in baseline activity and marked disruption of performance of the rotarod task. The apparently greater effect observed in the rotarod task is discussed in relation to the greater workload that task requires. Experiments are currently being conducted to identify the limits of detection and the quality of the sensory/perceptual experience of exposure to the TEMPO radiation. GRA

N88-27739# Army Aeromedical Research Lab., Fort Rucker, Ala.

SIMULATOR SICKNESS IN THE AH-64 APACHE COMBAT MISSION SIMULATOR Final Report

DANIEL W. GOWER, JR., MICHAEL G. LILIENTHAL, ROBERT S. KENNEDY, JENNIFER E. FOWLKES, and DENNIS R. BALTZLEY Nov. 1987 51 p

(Contract DA PROJ. 3E1-62777-A8-79)

(AD-A193419; USAARL-88-1) Avail: NTIS HC A04/MF A01 CSCL 06J

As technology has been developed to provide improved visual and motion systems in operational flight trainers and weapons tactics trainers, there have been increasing reports of the occurrence of simulator sickness. Simulator sickness here refers to one or more symptoms which can occur while in a simulator, immediately postexposure, or at some later time following exposure. Some pilots have reported while driving following postexposure, they had to pull off the road and wait for symptoms to subside. Instructor-operators have reported experiencing the room spinning when they went to bed. More critical is the potential for in-flight problems due to prolonged physiological effects. The U.S. Army Aeromedical Research Laboratory at Fort Rucker, Alabama, conducted a field survey to document the extent of the simulator sickness problems at operational AH-64 simulator sites. The simulator sickness incidence rates and the relative frequency of specific symptoms are presented and correlational factors such as flight experience, simulator experience, and flight mode also are presented. The study reinforces the need for continued research related to system design, training methods, and crew rest guidelines between simulator and actual flight. GRA

N88-27740# Kansas Univ., Lawrence.

DEMODULATION PROCESSES IN AUDITORY PERCEPTION Annual Report, 1 Dec. 1986 - 30 Nov. 1987

LAWRENCE L. FETH 1 Mar. 1988 5 p

(Contract AF AFOSR-0091-87)

(AD-A193421; AFOSR-88-0376TR) Avail: NTIS HC A02/MF A01 CSCL 06D

The attached interim report covers the first 12 month period of the project. A signal-processing computer model of human

auditory perception of complex, time-varying sounds has been revised to incorporate the ability to follow a frequency that changes over time. Such frequency changes are thought to convey the information important for the perception of speech, music and other important sounds. Testing of the revised model is underway using a two alternative forced choice discrimination task. Listeners are required to distinguish between a sound with a smooth linear frequency glide and another covering the same trajectory in a series of discrete steps. We expect to determine the temporal parameters for the revised model from these discrimination experiments. GRA

N88-27741# Naval Health Research Center, San Diego, Calif.
THE HUMAN ELEMENT IN SPACE: LESSONS FROM ANTARCTICA Final Report
LAWRENCE A. PALINKAS 10 Feb. 1988 23 p
(AD-A193440; NHRC-88-8) Avail: NTIS HC A03/MF A01 CSCL 05H

The ability of humans to adapt and perform in an extreme environment during periods of prolonged isolation is influenced by a number of social, cultural, and psychological parameters. These parameters must be taken into consideration in the design, construction, and operation of space facilities and off-world bases. This paper describes the human experience in the Antarctic and examines its relevance to the design and operation of manned space facilities and off-world communities. The author concludes that the human element in space may be enhanced by altering the environment or developing programs to strengthen the processes of adaptation and adjustment to this environment. GRA

N88-27742* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 314)
Sep. 1988 55 p
(NASA-SP-7011(314); NAS 1.21:7011(314)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 139 reports, articles, and other documents introduced into the NASA scientific and technical information system in August, 1988. Author

N88-28608# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE ROLE OF TEXTILE MATERIAL IN CLOTHING ON THERMOREGULATORY RESPONSES TO INTERMITTENT EXERCISE
RUTH NIELSEN and THOMAS L. ENDRUSICK Jan. 1988 9 p
(AD-A192599; USARIEM-M-21/88) Avail: NTIS HC A02/MF A01 CSCL 05H

The physiological effect of different textile material used in the underwear of an ensemble in the development of over heating or chilling in humans during intermittent exercise in a cold environment was studied. Underwear prototypes manufactured from five different fiber type materials were tested as part of a typical, standardized clothing system on eight male subjects. The test consisted of a twice repeated procedure of 40 min cycle exercise followed by 20 min of rest. Differences were found in both the amount of non-evaporated and evaporated sweat with the five different underwear configurations. No significant differences could be detected in esophageal temperature, skin temperature, skin wettedness, and onset time of sweating. It is concluded that the textile material used in underwear in a normal work garment has a small, but insignificant influence on the wet heat dissipation during intermittent exercise in a cool environment. GRA

N88-28609# Army Research Inst. of Environmental Medicine, Natick, Mass.
DEPRESSED SWEATING DURING EXERCISE AT ALTITUDE
MARGARET A. KOLKA, LOU A. STEPHENSON, and RICHARD R. GONZALEZ Feb. 1988 19 p
(AD-A192603; USARIEM-M-38/88) Avail: NTIS HC A03/MF A01 CSCL 06J

Acute exposure to moderate and high altitude resulted in a decrease in the thermosensitivity of arm, chest and thigh sweating during light and moderate exercise. This effect was not accompanied by any change in the esophageal temperature threshold for sweating onset at any of the three sites. Whole body wettedness was decreased an average of 23 percent at high altitude during light (40 percent VO2 peak) and moderate (60 percent VO2 peak) exercise. There was no change in mean weighted skin temperature at either moderate or high altitude. GRA

N88-28610# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE EFFECTS OF ACUTE COLD EXPOSURE ON EXERCISE PERFORMANCE
JOHN F. PATTON, III Feb. 1988 31 p
(AD-A192650) Avail: NTIS HC A03/MF A01 CSCL 06J

The physiological effects of a cold environment include peripheral vasoconstriction, shivering thermogenesis, and muscle tension development alterations. Performance in endurance events and performance in strength events have been discussed. Potential sites of cold injury have been reviewed, and the major forms of cold injury (including frostnip, hypothermia, frostbite) have been outlined. Both activity levels and clothing insulation are important to individuals who exercise in cold environments, as preventive measures. GRA

N88-28611# Army Research Inst. of Environmental Medicine, Natick, Mass.
HUMAN ACCLIMATIZATION AND PHYSICAL PERFORMANCE AT HIGH ALTITUDE
CHARLES S. FULCO Feb. 1988 28 p
(AD-A192651) Avail: NTIS HC A03/MF A01 CSCL 06J

A number of physiological adjustments occur when man is exposed to the hypoxia of high altitude. One of the most significant is a reduction in his maximal aerobic exercise performance. The component of systematic oxygen transport responsible for the early reduction in maximal aerobic power is the low arterial oxygen content, whereas decreased cardiac output is the reason for the persistence of the impairment after several days at high altitude. GRA

N88-28612# Army Research Inst. of Environmental Medicine, Natick, Mass.
ALTERATIONS IN CUTANEOUS VASOMOTOR REGULATION DURING ACUTE AND CHRONIC HYPOXIA
ALLAN J. HAMILTON, JOAN LAROVERE, and ALLEN CYMERMAN 26 Feb. 1988 27 p
(AD-A192653) Avail: NTIS HC A03/MF A01 CSCL 06J

The effects of acute and chronic hypoxic exposure on peripheral skin blood flow were examined in six naive subjects by measuring skin blood flow in the right index finger with a laser Doppler velocimeter. After baseline skin blood flows were determined, measurements of the vasoconstrictor responses to breath holding (BH), Valsalva maneuver (VM), and cold pressor test (CPT) employing ice water immersion of the contralateral hand were made. Subjects were first tested at sea level (SL), after two-hour exposure to a simulated altitude (SA) of 4300 meters (445 torr), and then tested on days 2, 3, 5, and 8 during chronic exposure at Pikes Peak, Colorado (4300 meters). Baseline and vasoconstrictor responses were not significantly altered by acute hypobaric exposure. However, during days 2 to 5 of chronic exposure there were significant falls in baseline peripheral skin blood flow. Similar reductions were also found in vasomotor responsiveness on days 2 to 5 but had recovered by day 8. GRA

N88-28613# Army Research Inst. of Environmental Medicine, Natick, Mass.
VARIABILITY IN INTAKE AND DEHYDRATION IN YOUNG MEN DURING A SIMULATED DESERT WALK Final Report, Jan. 1987 - Feb. 1988
PATRICIA C. SZLYK, INGRID V. SILS, RALPH P. FRANCESCONI,

ROGER W. HUBBARD, and WILLIAM T. MATTHEW 26 Feb. 1988 24 p
(AD-A192654) Avail: NTIS HC A03/MF A01 CSCL 06J

Voluntary dehydration was examined in young unacclimatized men walking under simulated desert conditions. Thirty-three subjects (20 to 33 yrs) walked on a treadmill for 30 min.h(-1) for 6 h in a hot environment (40 C db/ 26 C wb, 4.02 km.h(-1) windspeed). Cool (15 C) water was provided ad libitum in canteens. Two subpopulations of individuals were identified: those drinkers (D) (n=20) who maintained body weight loss at less than 2 percent and those who were reluctant to drink (reluctant drinkers, RD) (n=13) and lost more than 2 percent body weight (BW) despite continual availability of cool water. RD consumed 31 percent less water than D and this resulted in a significantly greater BW loss in RD than D. However, the only statistically significant differences in plasma indices of hypohydration were the higher final plasma Na+ and protein levels in RD. Rectal temperature was higher in the RD, whereas final heart rates were unaffected. Our results indicate that about 40 percent of young adult males may be reluctant to drink, thus will voluntarily dehydrate even when cool water ad libitum during intermittent exercise in the heat. The reduced intake of reluctant drinkers may be critical in predisposing them to increased risk of dehydration and heat injury. GRA

N88-28614# Army Research Inst. of Environmental Medicine, Natick, Mass.
HORMONAL REGULATION OF FLUID AND ELECTROLYTES: EFFECTS OF HEAT EXPOSURE AND EXERCISE IN THE HEAT
R. P. FRANCESCONI, M. N. SAWKA, R. W. HUBBARD, and K. B. PANDOLF Feb. 1988 35 p
(AD-A192655) Avail: NTIS HC A03/MF A01 CSCL 06J

An extensive review has been completed of the hormonal regulation of fluid and electrolyte balance during sedentary exposure to or exercise in the heat. The review focuses mainly on human responses although examples from animal studies are also included. The effects of exogenously administered hormones has been discussed followed by sections on hormonal response to sedentary heat exposure and exercise in the heat. Consideration of the exacerbative effects of hypohydration on the hormonal responses is followed by a section on electrolyte supplementation and the effects of heat acclimation. The review concludes with a discussion of the role of plasma volume in modifying the endocrinological responses as well as suggestions for future studies in this area. GRA

N88-28615# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE IMPACT OF HYPERTHERMIA AND HYPOHYDRATION ON CIRCULATION, STRENGTH, ENDURANCE AND HEALTH
LAWRENCE E. ARMSTRONG 5 Feb. 1988 27 p
(AD-A192657) Avail: NTIS HC A03/MF A01 CSCL 06J

This article reviews the effects of hot environments--and thus hyperthermia and hypohydration--on circulation, strength, endurance, and health in athletes. The cardiovascular responses to heat exposure at rest, and during exercise, are reviewed. Performance is reviewed by examining strength, power and endurance; the impact of hyperthermia, hypohydration and diuretic use on performance are discussed. The physiological needs for water, salt and carbohydrates have been examined. The four major heat illnesses (i.e., heat cramps, heat syncope, heat exhaustion, heatstroke) are described, as well as preventive measures to counteract hyperthermia and hypohydration. GRA

N88-28616# Army Research Inst. of Environmental Medicine, Natick, Mass.
INFLUENCE OF ALTITUDE AND CAFFEINE DURING REST AND EXERCISE ON PLASMA LEVELS OF PROENKEPHALIN PEPTIDE F Report, Jun. - Jul. 1986
WILLIAM J. KRAEMER, PAUL B. BOCK, CHARLES S. FULCO, SCOTT E. GORDON, and JEFF P. BONNER Feb. 1988 18 p
(AD-A192659) Avail: NTIS HC A03/MF A01 CSCL 06J

The purpose of this study was to examine the resting and exercise response patterns of plasma Peptide F immunoreactivity (ir) to altitude exposure (4300m) and caffeine ingestion (4mg.KgBW-1). Nine healthy male subjects performed exercise tests to exhaustion at sea level, during an acute altitude exposure (1 hr. hypobaric chamber) and after a chronic (17 day sojourn) altitude exposure. Using a randomized, double-blind/placebo experimental design, a placebo or caffeine drink was ingested 1 hour prior to exercise. Exercise (without caffeine) significantly (p less than 0.05) increased plasma Peptide F ir values during exercise at chronic altitude only. Caffeine ingestion significantly increased plasma Peptide F ir concentrations during exercise and in the post-exercise period at sea level. Conversely, caffeine ingestion at altitude resulted in significant reductions in the post-exercise plasma Peptide F ir values. The results of this study demonstrate that the exercise and recovery response patterns of plasma Peptide F ir may be significantly altered by altitude exposure and caffeine ingestion. These data support further study examining relationships between Peptide F (and other ECPs) and epinephrine release in response to these types of physiological stresses. GRA

N88-28617# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTS OF AIR POLUTION ON HUMAN EXERCISE PERFORMANCE
PETER N. FRYKMAN Feb. 1988 22 p
(AD-A192660) Avail: NTIS HC A03/MF A01 CSCL 24A

The pollutants commonly experienced in cities of the United States are: carbon monoxide, ozone, peroxyacetyl nitrate, aerosols, sulfur dioxide, and nitrogen dioxide. Only carbon monoxide has been show to reduce exercise performance. The investigations which evaluated the impact of other pollutants on performance, may not have been sensitive enough to detect the small performance decrements caused. Suggested ways to avoid performance decrements are included. GRA

N88-28618# Army Research Inst. of Environmental Medicine, Natick, Mass.
PROPRANOLOL AND THE COMPENSATORY CIRCULATORY RESPONSES TO ORTHOSTASIS AT HIGH ALTITUDE
CHARLES S. FULCO, ALLEN CYMERMAN, JOHN T. REEVES, PAUL B. ROCK, and LAURIE A. TRAD 14 Mar. 1988 18 p
(AD-A192675; USARIEM-M-37/88) Avail: NTIS HC A03/MF A01 CSCL 06J

Tachycardia has been shown to be an important response involved in the defense of cardiac output during orthostasis at high altitude. This study was undertaken to determine if tachycardia, mediated by beta-adrenergic sympathetic stimulation, actually represents an essential response. Twelve young, healthy male subjects received either 80 mg propranolol (n=6) or placebo (n=6) treatment, t.i.d. at sea level and for 3 days prior to and during the first 15 days of a 19-day altitude sojourn. Individuals were randomly assigned to each group. Upright tilt tests were performed at sea level on and off treatment, at high altitude during days 2,7, and 15 on treatment, and on day 19 off treatment. Heart rate, stroke volume, calf blood flow, and blood pressure were obtained during supine rest and after 12 minutes of 60 deg tilt. There were no differences between groups in any of the circulatory measurements at sea level and altitude while off treatment. While on treatment at sea level and altitude, propranolol caused reductions in heart rate and blood pressure values in each position (p is less than 0.05). Supine and upright cardiac output, however, were found not altered due to compensatory increases in stroke volume (p is less than 0.05). It was concluded that tachycardia, both at rest and during upright tilt at high altitude is important, but not essential to defend cardiac output. GRA

N88-28619# Army Research Inst. of Environmental Medicine, Natick, Mass.
BIOMEDICAL ASPECTS OF MILITARY OPERATIONS AT HIGH ALTITUDE
ALLAN J. HAMILTON 29 Feb. 1988 35 p
(AD-A192677; USARIEM-M-30/88) Avail: NTIS HC A03/MF A01 CSCL 06E

High terrestrial elevation with its corresponding hypoxia offers

one of the most inhospitable and debilitating environments found anywhere on the planet. Warfare in such a setting is a formidable undertaking. Twice in the last 25 years, major powers in Asia have waged wars at high altitude. Their experiences, as well as limited clinical studies involving soldiers and mountaineers, have outlined how dramatic a factor acute mountain sickness (AMS) will play in any high altitude military operation. This review outlines the hazards peculiar to high altitude and summarizes the clinical and military studies which are pertinent to developing strategies for acclimatization and prophylaxis of illness in troops committed to high altitude warfare. Finally, general medical guidelines for planning military operations at high terrestrial elevation are established, and the applications of high altitude as a tactical weapon in such scenarios is discussed. GRA

N88-28620# Imatran Voima Oy, Helsinki (Finland).
PHYSIOLOGICAL EFFECTS OF EXTREMELY LOW FREQUENCY ELECTRIC AND MAGNETIC FIELDS
J. VALJUS 1987 159 p In FINNISH; ENGLISH summary
(DE88-752814; IVO-A-04/87) Avail: NTIS (US Sales Only) HC A08/MF A01

According to literature, extermely low frequency (ELF) electric and magnetic fields can affect several physiological systems. However, there are no undisputable evidence of adverse effects on one's health even in fields far exceeding the electric field strengths and magnetic flux densities existing in practice. From epidemiological studies there is some evidence available on the connection of magnetic field exposure and cancer. This connection is, however, so weak that it is very difficult to point it out among the many other environmental factors. In laboratory tests magnetic field has been found to affect the development of chick embryos. In mammals such effects are far more uncertain. In general, magnetic field is considered a greater risk factor than electric field. Strong electric fields may, nevertheless, cause symptoms to patients with cardiac pacemakers, and e.g., spark discharges which may cause chromosome exchanges with, at least in principle, adverse health effects. The adverse health effects of electric and magnetic fields can only be detected in large test groups. Still, the hazards to the environmental and the labor welfare by these fields are worth studying as a part of the purity and safety image of electrical energy. Such research would also give a good basis for public information, attitudes for government policy and also for practical measures, if required. DOE

N88-28621# Air War Coll., Maxwell AFB, Ala.
STRESS/FATIGUE AND THE ARNG (ARMY NATIONAL GUARD) AVIATOR
KENNETH D. RHOADES 28 Mar. 1988 38 p
(AD-A194184) Avail: NTIS HC A03/MF A01 CSCL 01B

As a result of national policy, Army National Guard (ARNG) aviation units contain thirty-three percent of today's United States Army aviation program. In the event of a national emergency requiring military force, Guard aviation is scheduled to be mobilized and used along with Active Component aviation; no other force structure choice exists. Increased reliance on Guard aviation has brought more equipment, additional training facilities, and dramatic increases in individual aviator training requirements. In addition, ARNG aviation national defense responsibility is increasing with the addition of new equipment and reorganized aviation force structure. By 1989, ARNG aviation will include 283 units with authorization for over 6,600 aviators and 2400 aircraft. The long-term success of ARNG aviation requires that Guard leaders and individual aviators be aware of and minimize stress and its effects. Training Guard aviators, who must safely meet the same training requirements as their Active Army counterparts, represents a significant ARNG leadership challenge. Yet stress in the ARNG aviation environment has received little attention. This paper examines stress and stressors in the ARNG aviation program, and means of minimizing the harmful effects of stress in Guard aviation programs. GRA

N88-28622*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERPLANETARY TRAVEL: IS GRAVITY NEEDED TO CLOSE THE LOOP
JOAN VERNIKOS-DANELLIS Aug. 1988 19 p
(NASA-TM-101013; A-88241; NAS 1.15:101013) Avail: NTIS HC A03/MF A01 CSCL 06S

Evidence has been accumulating from spaceflight and ground simulation studies suggesting that the normal relationship between neuroendocrine driving mechanisms and their respective target organs may become uncoupled; and that the sensitivity of the various components of the closed-loop systems may be altered. Changes in the regulation of the pituitary-adrenal system and the angioten-sinaldosterone system is discussed in support of this thesis. Author

N88-28623# Defence Research Establishment, Ottawa. (Ontario).
SOFTWARE MODIFICATIONS TO TOTAL DATA REPORTING ACCESSORY FOR METABOLIC MEASUREMENT CART
R. W. NOLAN, C. W. GIBSON, and S. D. LIVINGSTONE Aug. 1987 12 p
(AD-A193641; DREO-TN-8732) Avail: NTIS HC A03/MF A01 CSCL 06D

The Total Data Reporting Accessory available for the Beckman Metabolic Measurement Cart has characteristics which limit its use in a research laboratory. Storage of test results and retrieval for subsequent analysis is awkward. In addition, metabolic data from only one individual can be measured during a given test. This is a serious limitation when two or more persons participate in the same experiment. Software modifications which have been made to overcome these difficulties are described. GRA

N88-28624# New York Univ., New York.
NEW METHOD FOR THE STUDY OF SPONTANEOUS BRAIN ACTIVITY Report, 1 Jan. 1987 - 28 Feb. 1988
R. J. ILMONIEMI, SAMUEL J. WILLIAMSON, and W. E. HOSTETLER 28 Feb. 1988 5 p
(Contract F49620-85-K-0004; SCEE-HER/86-14)
(AD-A193813; AFOSR-88-0345TR) Avail: NTIS HC A02/MF A01 CSCL 06E

A new method has been developed to characterize the sources of spontaneous brain activity measured magnetically while avoiding any specific model for the neural generators. In an application of the technique, individual spindles of the alpha rhythm monitored by a set of 14 magnetic sensors fixed over the occipital lobe were characterized as vectors in a 14-dimensional signal space. Taking the noise level into account, the number of distinct vectors could be determined, which indicates the number of sources that differ in their geometrical attributes such as position, orientation, and extent. In a pilot study of about 30 spindles for each of two subjects, virtually all sources were distinguishable from the others, implying a large set of underlying generators. GRA

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BEHAVIORAL SCIENCES

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

A88-49549
INVESTIGATION OF THE STRUCTURE OF THE INTERPERSONAL INTERACTION IN A SMALL GROUP APPLICABLE TO THE PROBLEM OF SELECTING SPACECRAFT CREWS [ISSLEDOVANIE STRUKTURY MEZHLICHNOSTNOGO VZAIMODEISTVIIA V MALOI GRUPPE PRIMENITEL'NO K ZADACHAM KOMPLEKTOVANIIA EKIPAZHEI KOSMICHESKIKH KORABLEI]

JAN TERELAK (Wojskowy Instytut Medycyny Lotniczej, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 20, no. 3-4, 1987, p. 61-78. In Russian. refs

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

A88-49747
VALIDATION OF PSYCHOLOGICAL SELECTION PROCEDURE FOR OPERATIONAL TASKS IN AIR AND SPACE TRAVEL [ZUR BEWAEHRUNG PSYCHOLOGISCHER AUSWAHLVERFAHREN FUER OPERATIONELLE BERUFE IN DER LUFT- UND RAUMFAHRT]
P. MASCHKE and H.-J. HOERMANN (DFVLR, Institut fuer Flugmedizin, Hamburg, Federal Republic of Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung (ISSN 0342-068X), vol. 12, May-June 1988, p. 181-186. In German. refs

The validation of a psychological concept for the selection of highly qualified operators for air and space travel is studied. Of 399 student airline pilots recruited with this procedure, 349 (88 percent) completed the flight training successfully. Multivariate statistical analysis based on pass/fail criteria and instructor's ratings resulted in acceptable validity coefficients. Whereas tests of psychomotor coordination and multiple task performance proved to be significant predictors for training success as a whole, such characteristics as mathematical reasoning, mental concentration, perceptual speed, and spatial orientation were more related to the instructor's ratings. The significance of psychological aptitude testing for the efficiency of man/machine interactions is discussed. C.D.

A88-49784
MOTION SICKNESS AND ANXIETY
SHAUL FOX (Bar-Ilan University, Ramat-Gan, Israel) and ISAAC ARNON Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 728-733. refs

Ninety-four Israeli pilot trainees completed a battery of anxiety-related questionnaires: Taylor Manifest Anxiety Scale, EPQ, 16PF, and Spielberger's State and Trait Anxiety Scores. Self reports and flight instructor observations of motion-sickness symptoms were collected after initial flights. No significant correlations were found between these two sources. Anxiety scores derived from the battery of anxiety questionnaires were correlated with self reports of motion sickness but not with instructor observations. Discussion focused on the potential limitations of external observers in assessing motion sickness, the convergence of anxiety assessments, and the overlap between anxiety and motion sickness symptoms. Methodological and practical implications conclude the review. Author

A88-49791
POST ACCIDENT/INCIDENT COUNSELING - SOME EXPLORATORY FINDINGS
A. N. JOHNSTON and M. G. KELLY (International Federation of Air Line Pilots Associations, Egham, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 766-769. refs

An examination of the literature and other sources of information suggests that there might be prophylactic value in early psychological intervention following crewmember involvement in stressful incidents. An exploratory study at a small commercial pilot base (about 200 pilots) was undertaken to assess the value of early intervention. Pilots were automatically referred to an independent counseling service if abnormal flight events were judged to have involved sudden, unanticipated, or extreme stress. While some individuals came through their experience relatively unaffected, a surprising proportion did not. Several individuals took the opportunity to voluntarily return for additional counseling while others required anxiolytic drug treatment. The initial findings of this exploratory study strongly suggest that commercial pilots are more frequently subject to a potentially debilitating stress reaction than heretofore suspected. This has obvious implications for intervention, prevention, and long-term stress management for commercial pilots. Author

A88-49792
A PROPOSAL FOR A DIAGNOSTIC COLOUR VISION STANDARD FOR CIVIL AIRMEN
ADRIAN B. ZENTNER (Department of Transport and Communications, Canberra, Australia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Aug. 1988, p. 770-775. refs

Advances in medical technology, aviation technology, and operational procedures have created a rapidly changing background against which assessment of fitness to fly must be made. The current paper examines such changes in relation to the color perception standard. The necessity for adequate color perception in the modern aviation environment is reviewed and a rational sequence of tests to define aviation safe color perception is proposed. Author

A88-49924#
MAINTENANCE PSYCHOLOGY ANALYSIS UNDER VARIOUS DETECTION MODES
XUEYAO CHEN (Naval Aeronautical Engineering Academy, People's Republic of China) Acta Aeronautica et Astronautica Sinica (ISSN 1000-6893), vol. 9, June 1988, p. B265-B271. In Chinese, with abstract in English. refs

The optimal psychological profiles for aircraft maintenance personnel are discussed, with a focus on the different types of man-machine interfaces involved. Particular attention is given to direct visual or manual fault detection, instrument detection, and intelligent-machine detection. Also included are recommendations on training methods for each type of task. T.K.

A88-50276*# Purdue Univ., West Lafayette, Ind.
MODELING HUMAN PERCEPTION AND ESTIMATION OF KINEMATIC RESPONSES DURING AIRCRAFT LANDING
DAVID K. SCHMIDT (Purdue University, West Lafayette, IN) and ANTHONY B. SILK IN: AIAA Guidance, Navigation and Control Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 1117-1126. refs
(Contract NAG4-1)
(AIAA PAPER 88-4186)

The thrust of this research is to determine estimation accuracy of aircraft responses based on observed cues. By developing the geometric relationships between the outside visual scene and the kinematics during landing, visual and kinesthetic cues available to the pilot were modeled. Both fovial and peripheral vision was examined. The objective was to first determine estimation accuracy in a variety of flight conditions, and second to ascertain which parameters are most important and lead to the best achievable accuracy in estimating the actual vehicle response. It was found that altitude estimation was very sensitive to the FOV. For this model the motion cue of perceived vertical acceleration was shown to be less important than the visual cues. The inclusion of runway geometry in the visual scene increased estimation accuracy in most cases. Finally, it was shown that for this model if the pilot has an incorrect internal model of the system kinematics the choice of observations thought to be 'optimal' may in fact be suboptimal. Author

A88-50277#
PILOT DECISION MAKING DURING LOW ALTITUDE WINDSHEAR ENCOUNTERS

EZRA S. KRENDEL, R. WADE ALLEN, DUANE T. MCRUER, and ZAREH PARSEGHIAN (Systems Technology, Inc., Hawthorne, CA) IN: AIAA Guidance, Navigation and Control Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 1127-1134.
(AIAA PAPER 88-4187)

A portable noninteractive microcomputer based simulator was used to study pilot decision making in evaluating microburst windshear threats. A weighted combination of the information from several categories (long term weather forecasts, midterm reports from visual observations and the low level windshear alert system, and immediate data from the aircraft's response and instrument readouts) is used by a pilot/subject in the role of 'pilot not flying' to generate ratings for the subjective probability of encountering a microburst in response to simulator presentations of landings and takeoffs. Results are presented for seven pilots/subjects. R.R.

A88-50701
INCREASING THE EFFICIENCY OF AVIATION SKILL FORMATION BY MEANS OF AN ACCELERATION-LOAD TRAINING SIMULATOR [O POVYSHENII EFFEKTIVNOSTI FORMIROVANIIA LETNYKH NAVYKOV S POMOSHCH'IU SISTEMY IMITATSII PEREGRUZOK NA TRENAZHERE]
V. F. ZHERNAVKOV and V. I. ZORILE Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), June 1988, p. 45-48. In Russian. refs

This paper describes the results of pilot training on a system that simulates sudden changes in vertical acceleration (effected by changes in the pressure of the protective suit and by the positional changes of the pneumatic seat), and the results are compared with results of training conducted without simulated Gz loading. It is shown that a training scheme that included a Gz-load simulation was very effective for teaching the necessary posture maintenance maneuvers during Gz-loads with high Gz gradients, and for the development by the trainees of various protective methods that reduce the effects of Gz-overload. The Gz-simulation system increased the efficiency of training of both novice pilots and experienced pilots trained on new aircraft systems. I.S.

A88-50762
ELEMENTS OF AVIATION PSYCHOLOGY [OSNOVY AVIATSIONNOI PSIKHOLOGII]
KONSTANTIN KONSTANTI PLATONOV and BORIS MARKOVICH GOL'DSHTEIN Moscow, Izdatel'stvo Transport, 1987, 224 p. In Russian. refs

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

A88-51496
ENGINEERING DATA COMPENDIUM: HUMAN PERCEPTION AND PERFORMANCE
KENNETH R. BOFF, ED. (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and JANET E. LINCOLN, ED. (Dayton, Univertsity, OH) Wright-Patterson AFB, OH, USAF Aerospace Medical Research Laboratory, 1988, 142 p. No individual items are abstracted in this volume.

Information and instructions for users of the Engineering Data Compendium on human perception and performance are presented. The layout of the two-page entries which make up the Compendium is explained and illustrated with a diagram. A table of contents for volumes 1-3, a glossary of terms, a hierarchically arranged design checklist, and a complete alphabetical index are provided. T.K.

A88-51497
ENGINEERING DATA COMPENDIUM. VOLUME 3 - HUMAN PERCEPTION AND PERFORMANCE
KENNETH R. BOFF, ED. (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and JANET E. LINCOLN, ED. (Dayton, University, OH) Wright-Patterson AFB, OH, USAF Aerospace Medical Research Laboratory, 1988, 845 p. No individual items are abstracted in this volume.

Information on the human sensory and motor systems is compiled in two-page summaries for use in the engineering design of man-machine interfaces. Detailed tables of contents, lists of key terms, and glossaries are provided for each section, and extensive use is made of diagrams, flow charts, and graphs. Areas covered include language processing, operator motor control, the effects of environmental stressors, display interfaces, and real and virtual control interfaces. T.K.

A88-52127
STUDIES OF DYNAMIC TASK ALLOCATION IN AN AERIAL SEARCH ENVIRONMENT
NANCY M. MORRIS, WILLIAM B. ROUSE (Search Technology, Inc., Norcross, GA), and SHARON L. WARD IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 18, May-June 1988, p. 376-389. refs
(Contract F33615-82-C-0509; F33615-86-C-0545)

Results of two experiments in dynamic task allocation are discussed. Subjects performed two concurrent computer-based tasks: visual target identification and subcritical compensatory tracking. Target identification could be allocated dynamically to human or computer aid. Three aiding conditions were investigated: no aid, manual aid (with subjects making the allocation decision), and automatic aid (with allocation decisions based on models of human performance). The results indicated that: (1) overall performance was better with the aid available; (2) need for the aid depended on both current and previous task states; (3) unaided performance was benefited by having an aid available, but only if subjects were in charge of task allocation; and (4) although overall performance was better with the automatic aid, subjects preferred the manual aid. The implications of these and other results are discussed. I.E.

N88-27360# Montclair State Coll., Upper Montclair, N.J. Dept. of Psychology.
A REVIEW OF WORKLOAD MEASUREMENT IN RELATION TO VERBAL COMPREHENSION Final Report
STEPHEN T. MORGAN *In* Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 2 20 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 05I

In a command and control environment, many individuals are called upon to engage in two activities simultaneously. Communication with others is often one of these tasks. It is crucial that there be no decrement in performance on either task, especially in crises situations where heavy loading on the cognitive system is apt to be present. In order to optimize an individual's performance, processing strategies need to be analyzed and the most efficient ones incorporated into appropriate training programs. The literature is reviewed regarding workload measurement techniques. The purpose is to investigate the most efficacious method of assessing processing load during verbal comprehension. Dual task paradigms are found to be valid indices of mental workload. Problems associated with this technique are evaluated and a possible assessment method is offered. Author

N88-27362# Northwestern Univ., Evanston, Ill. Dept. of Psychology.
THE EFFECTS OF INCREASED COGNITIVE DEMANDS ON AUTONOMIC SELF-REGULATION: AN INDICATOR OF PARALLEL PROCESSING IN THE BRAIN Final Report
VICTORIA TEPE NASMAN *In* Universal Energy Systems, Inc.,

United States Air Force Graduate Student Summer Support Program, Volume 2 13 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSCL 05I

A parallel processing scheme is proposed. Schemes were tested through a single subject experimental design in which subjects performed several tasks. Ongoing electroencephalographic signals were recorded over left and right occipital cortex, and compared between tasks within session. As expected, while performing various meditation and biofeedback tasks, subjects demonstrated characteristic dominant frequencies of 7 to 13 Hz (alpha). When performing such a task concomitant with another highly associative cognitive task, however, subjects produced results more like those obtained in the performance of the cognition task alone. These results support the notion that, while engaged in tasks which would require parallel brain processing, processes which would otherwise rely upon serial processing are uncoupled. A scheme is proposed upon which this interpretation is based. Although performance data on the cognitive task have not yet been analyzed, the preliminary interpretation of the data is that evidence was obtained to support a view of cognitive processing in which the flexibility to process either serially or in parallel exists, and in which the type of processing that is invoked will coincide with the demands of the task/tasks. Author

N88-27698# Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg (Netherlands). Human Performance Group.
USING ERPS TO STUDY HUMAN INFORMATION PROCESSING
A. W. K. GAILLARD *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 6 p Feb. 1988
Avail: NTIS HC A18/MF A01

The event-related brain potential (ERP) technique may provide an inobtrusive measure of the processing of psychological information during task performance. Some investigators regard ERPs even as a direct manifestation of the ongoing psychological processes. Before such a strong claim can be made several methodological problems have still to be solved. The definition and identification of the various components in the ERP, the separation of exogenous and endogenous components, and the differenct ways in which inferences can be made about psychological processes on the basis of ERP components, is the low comparability of ERP measures across paradigms are discussed. Author

N88-27701# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE EFFECT OF ENDOGENOUS ALPHA ON HEMISPHERIC ASYMMETRIES AND THE RELATIONSHIP OF FRONTAL THETA TO SUSTAINED ATTENTION
R. PIGEAU, R. HOFFMANN, S. PURCELL, and A. MOFFITT (Carleton Univ., Ottawa, Ontario) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 16 p Feb. 1988
Avail: NTIS HC A18/MF A01

Data are represented which suggest that the degree of hemispheric alpha asymmetry is related to resting eyes closed endogeneous alpha activity. Also, it is demonstrated that frontal theta activity varies with the difficulty level of an additional tasks. Both results share a common emphasis on electrophysiological individual difference. The electroencephalogram (EEG) recordings from 54 right-handed subjects performing 5 cognitive tasks were collected and quantified using period analysis. The subjects were rank ordered on the basis of their hemispherically averaged alpha activity during an eyes closed baseline condition. A similar procedure was performed for frontal theta to distinguish theta generators. Utilizing a L-R/L+R asymmetry index the results indicate that high and middle alpha generators displayed the hypothesized and asymmetry relationship whereas the low alpha generators did not. This implies that low alpha generating subjects may negatively affect EEG laterality studies. Results from the addition task indicate that hemispherically averaged theta activity varies curvelinearily as a function of increaseing task difficulty. Subjects displaying higher performance scores on the additional task also demonstrate higher frontal theta values, suggesting theta is associated with sustained focused attention of higher order cognitive processes. Author

N88-27707# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE NEUROELECTRIC SELECTION OF NAVAL AVIATION PERSONNEL: AN EVALUATION
R. R. STANNY, D. L. REEVES, M. R. BLACKBURN, and G. R. BANTA (Naval Medical Research and Development Command, Bethesda, Md.) *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 8 p Feb. 1988
Avail: NTIS HC A18/MF A01

The value of using event-related potentials to predict success in naval aviation is examined. The background of the project, some methodological considerations, and the approach to the problem are discussed. Some early results have become available and are encouraging. Author

N88-27711# Veterans Administration Hospital, Sepulveda, Calif. Neuropsychology Research Dept.
ELECTROENCEPHALOGRAPHIC CORRELATES OF PILOT PERFORMANCE: SIMULATION AND IN-FLIGHT STUDIES
M. B. STERMAN, G. J. SCHUMMER, T. W. DUSHENKO, and J. C. SMITH *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 16 p Feb. 1988
(Contract AF-AFOSR-0231-83; AF-AFOSR-0335-82)
Avail: NTIS HC A18/MF A01

Both laboratory and in-flight studies were performed in order to evaluate the utility and feasibility of EEG monitoring as a means of identifying central nervous system correlates of performance and G-force effects during military flight operations. Four studies were conducted, two with controlled laboratory simulation, and two in actural flight during military training missions. Data analysis focused on EEG power-spectral density characteristics and their temporal modulation, specifically in sensorimotor and visual cortical areas. Several consistent findings emerged. During competent performance, a highly unique discrepancy appeared between the left and right hemispheres in central 8 to 15 Hz activity. This pattern disappeared as performance degraded. The temporal modulation of this activity also reflected these changes. During high G-force situations, power at frequencies below 8 Hz was progressively and non-specifically enhanced. Continued competent performance, however, was still reflected by the pattern described. These findings are discussed in terms of their neurophysiological implications. Author

N88-27719# Hellenic Air Force General Hospital, Athens (Greece). Neurological Clinic.
CORRELATION BETWEEN EEG ABNORMAL ACTIVITY AND AIRCRAFT ACCIDENTS: A LONG TERM OBSERVATION
A. STAVROPOULOS *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 5 p Feb. 1988
Avail: NTIS HC A18/MF A01

During 1975 to 1976, 64 student pilots of the Hellenic Air Force Air Academy were studied with electroencephalographic protocol including activation procedures. In 13 of them, abnormal encephalographic activity was observed. During their 10-year flying career as fighter pilots, six pilots with abnormal EEGs were involved in 10 aircraft accidents due to pilot error, while only 3 pilots of the 51 with normal EEGs were involved in 4 accidents due to pilot errors. Author

N88-27743# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
ASSESSING AND ENHANCING HUMAN PERFORMANCE: UTILITY OF A WORKSTATION NETWORK Final Report, 1 Oct. 1986 - 1 Oct. 1987

BERT F. GREEN, JR., STEVEN J. BRECKLER, HOWARD E. EGETH, and NEAL J. COHEN 20 Mar. 1988 10 p
(Contract AF-AFOSR-0068-87)
(AD-A192840; JHU-RR-88-100; AFOSR-88-0440TR) Avail: NTIS HC A02/MF A01 CSCL 05I

An articulated state of the art network of computer based workstations has been installed and is being used for behavioral and personnel research. This report describes the network configuration, discusses the current experience in using the equipment, and identifies current research projects that are using the equipment. GRA

N88-27744# Northeastern Univ., Boston, Mass.
A MODEL FOR VISUAL ATTENTION Technical Report, Mar. 1987 - Mar. 1988
ADAM REEVES 1 Apr. 1988 8 p
(Contract AF AFOSR-0172-87)
(AD-A193061; AFOSR-88-0485TR) Avail: NTIS HC A02/MF A01 CSCL 06D

Research has been undertaken on visual attention and short term visual memory (VSTM). One set of experiments has concerned the role that depth information might play in retrieval from VSTM, using an iconic memory paradigm. Another set concerns development of the attention gating model, using the attention shift RSVP paradigm. Finally, we are studying some effects of attention and visual imagery on visual acuity. GRA

N88-27745# Northwestern Univ., Evanston, Ill. Neuroscience Lab.
PERCEPTION OF MOTION IN STATISTICALLY-DEFINED DISPLAYS Annual Scientific Report, 1 Oct. 1986 - 30 Sep. 1987
ROBERT SEKULER 15 Feb. 1988 102 p
(Contract AF AFOSR-0370-85)
(AD-A193076; AFOSR-88-0288TR) Avail: NTIS HC A06/MF A01 CSCL 05H

Though motion perception does depend upon spatially local processes, under certain circumstances global processes make an important contribution. For example, the human visual system can integrate different, spatially-intermingled motion vectors into a global percept of motion in a single direction. Such integrated percepts may offer important clues to the mechanisms of motion perception. To exploit such clues we have followed the tradition of using discrimination performance to probe underlying psychophysical mechanisms. Specifically, we were interested in how easily observers could discriminate between two different global motions when each had resulted from the integration of many different motion vectors. Our stimuli were random dot cinematograms in which each dot took an independent two-dimensional random walk with steps of constant size. The direction any dot moved, from one display frame to the next, was independent of the dot's previous movements as well as the movements of other dots. All dots chose their directions of movement from the same probability distribution. GRA

N88-27746# Air Force Human Resources Lab., Brooks AFB, Tex.
PERSONALITY, ATTITUDES, AND PILOT TRAINING PERFORMANCE: PRELIMINARY ANALYSIS Interim Report, Jan. 1983 - Jan. 1987
FREDERICK M. SIEM, THOMAS R. CARRETTA, and THERESA A. MERCATANTE May 1988 20 p
(AD-A193102; AFHRL-TP-87-62) Avail: NTIS HC A03/MF A01 CSCL 05I

Developments in research concerning personality characteristics have led to a renewed interest in applications of individual measures for selection of pilot candidates. Recent research efforts have focused on selecting for positive characteristics, rather than screening out pathological traits. Another development is the use of tests in which the dimension of interest is not readily apparent to the examinee. In the present study, five personality and attitude measures were administered to 883 USAF pilot candidates as part of an experimental test battery under consideration for operational use in pilot selection and classification. These tests were designed to assess decisiveness, risk-taking, self-confidence, survival attitudes, and field dependence/independence. Scores from these tests were examined for their utility in predicting training outcome (graduation or elimination) and advanced training recommendation (fighter or non-fighter aircraft). Results indicated that as a group, the tests demonstrated weak relationships with the performance criteria. No test manifested a consistent pattern of validity for both performance measures. Only the test of self-confidence appeared to contribute to predicting completion of training. Future research efforts are discussed with regard to refining the current test of self-confidence and establishing its construct validity. GRA

N88-27747# New York Univ., New York.
COGNITIVE AND NEURAL BASES OF SKILLED PERFORMANCE Annual Technical Report, Sep. 1986 - Sep. 1987
LLOYD KAUFMAN 4 Oct. 1987 179 p
(Contract F49620-86-C-0131)
(AD-A193392; AFOSR-87-1710TR) Avail: NTIS HC A09/MF A01 CSCL 05H

Research in seven interrelated areas has been carried out during this first year. A major advance in the capability of neuromagnetic monitoring of higher levels of brain function was achieved with the installation of a large magnetically shielded room for the sensing system. This together with a computer-controlled adaptive filter dramatically improved sensitivity to slowly-varying brain signals. A new analysis technique based on a multidimensional signal space has also been developed to characterize the neural configurations that give rise to differing field patterns, without restricting consideration to only the simplest that can be attributed to an equivalent current dipole. Successful application of these concepts to studies of the alpha rhythm also demonstrated a major advantage in using elements of the covariance matrix across sensors to reduce interference from extraneous neural sources, thereby improving the signal-to-noise ratio by an order of magnitude. In preparing for a series of collaborative studies, various methods for producing visual displays in the shielded room were evaluated, and one based on a single-lens TV projection system was chosen. The system can be controlled by a computer peripheral to the HP9000/550 used to record and analyze neuromagnetic data. Software was successfully developed so that either an IBM/PC-compatible or Amega computer can be used for this purpose. An Adage 3000 frame buffer was obtained for psychophysical studies, and programs were developed to present a display where only color or only luminance changes are produced. GRA

N88-27748# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abteilung Luft- und Raumfahrtpsychologie.
DETERMINANTS OF DUAL-TASK INTERFERENCE AND RESOURCE THEORIES IN COGNITIVE PSYCHOLOGY Ph.D. Thesis - Kiel Univ.
DIETRICH MANZEY Feb. 1988 234 p In GERMAN; ENGLISH summary
(DFVLR-FB-88-14; ISSN-0171-1342; ETN-88-92932) Avail: NTIS HC A11/MF A01; DFVLR, VB-PI-DO, 90 60 58, 5000 Cologne, Federal Republic of Germany, 64 deutsche marks

In two experiments (22 subjects) the determinants of interference effects are investigated by an analysis of performance-operating characteristics for several different task-combinations. It can be shown that the degree of task-interference in dual-task situations depends mainly on the similarity of both tasks with regard to their perceptual-cognitive and response-related demands, and that task difficulty is of minor importance for dual-task interference effects. The results are interpreted as a proof for the prognostic value of a certain model of human timesharing: the theory of multiple resources. ESA

N88-28625# Army War Coll., Carlisle Barracks, Pa.
TACTICAL AIR FORCE NIGHT/ADVERSE WEATHER TRAINING
CHARLES A. KITTLES 16 Feb. 1988 34 p
(AD-A194243) Avail: NTIS HC A03/MF A01 CSCL 05I

Currently the United States military forces face adversaries that are committed to around the clock combat operations. The U.S. Air Force and U.S. Army have initiated joint programs to equip and train our forces to effectively combat the threat. The U.S. Air Force and U.S. Army have not fully met that challenge. This study seeks to examine the U.S. Air Force commitment to that challenge. Following a threat statement, a historical review of selected fighter mishaps will set the stage for a brief look at lessons learned from these mishaps. Previous studies on night tactical warfare and the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system will provide additional background data for identification and discussion of unresolved issues. The draft concept of training (COT) documents for the LANTIRN equipped F-16C/D and F-15E will also be reviewed prior to a discussion of both old and new issues. Recommendations and conclusions regarding the U.S. Air Force commitment to counter the threat, day or night, conclude this study. GRA

N88-28626# Air Command and Staff Coll., Maxwell AFB, Ala.
STRESS AND THE MILITARY PILOT
SIDNEY K. BARWICK Apr. 1988 43 p
(AD-A194313; ACSC-88-0230) Avail: NTIS HC A03/MF A01 CSCL 05I

This Thesis studies how stress (psychological) effects the military pilot in peacetime and combat with emphasis on prevention, recognition, and treatment. Stress and its effects on military pilots is a subject where the author's personal experience has indicated a need for increased knowledge. Understanding and controlling the stress that effect the military pilot will help improve safety and combat effectiveness. If the pilot and supervisor insure that the mind is ready for each mission, then the Air Force will log more landings per take-off. In combat, stress disorders are treatable if recognized early and treated correctly. Proper treatment will help assure combat missions will not be lost to the psychological effects of war. In the thesis, the author translated the preventions, recognition, and treatments for ground combatant stress directly to the military pilot population. Additionally, posttraumatic stress is addressed with the hope of finding ways to reduce or prevent it. GRA

N88-28627# New York Univ., New York.
DIVIDED ATTENTION REVISITED: SELECTION BASED ON LOCATION OR PITCH Report, 1 Jan. - 28 Feb. 1988
LLOYD KAUFMAN, SAMUEL J. WILLIAMSON, and S. CURTIS 28 Feb. 1988 5 p
(Contract F49620-85-K-0004)
(AD-A193814; AFOSR-88-0343TR) Avail: NTIS HC A02/MF A01 CSCL 05H

The effect of attention on the level of cortical activity in human subjects was investigated by use of a novel paradigm involving the rapid and simultaneous presentation of two sequences of tones having different sets of frequencies. Measurements of the magnetic field of both the N100 and P200 components originating in auditory cortex showed enhancement for the attended sequence in comparison with the ignored sequence. This was observed whether the sequences were presented to different ears or the same ear. Thus pitch alone is a sufficient clue for attention. These results are also in general agreement with filter theories that postulate the attention of ignored stimuli prior to conscious perception. GRA

N88-28628# *Colorado Univ., Boulder.*
SKILLED MEMORY AND EXPERTISE: MECHANISMS OF EXCEPTIONAL PERFORMANCE Final Report, 1 Mar. 1984 - 28 Feb. 1987
K. A. ERICSSON 31 Mar. 1988 98 p
(Contract N00014-84-K-0250)
(AD-A193829) Avail: NTIS HC A05/MF A01 CSCL 05H

Skilled memory theory describes how subjects can acquire exceptional memory skills and thereby develop long-term memory with performance characteristics comparable to those of short-term memory. The research reported in this paper has further investigated the detailed mechanisms of exceptional digit span and has explored the generalizability of skilled memory theory to account for the superior memory of memory experts and of other experts in their domains of expertise. Two new studies tested three principles of skilled memory in the domain of exceptional digit span. One study showed that encoding a four-digit number as a unit (e.g., coding 3526 as a running time for a race) enables even expert runners to reliably retrieve only the first two digits of the number. The other study demonstrated that in addition to encoding numbers as running times, subjects encoded other patterns and relations between digits. This study also monitored in detail the emergence of a retrieval structure as a function of practice. A review of studies of individuals with exceptional memory shows that skilled memory theory can account for all available evidence on exceptional memory. GRA

N88-28629 Pennsylvania Univ., Philadelphia.
MODELS FOR MOTION PERCEPTION Ph.D. Thesis
DAVID J. HEEGER 1987 150 p
Avail: Univ. Microfilms Order No. DA8804911

As observers move through the environment or shift their direction of gaze, the world moves past them. In addition, there may be objects that are moving differently from the static background, either rigid body motions or nonrigid ones. Several models for motion perception are studied. The models rely on first measuring motion energy, a multiresolution respresentation of motion information extracted from image sequences. The image flow model combines the outputs of a set of spatiotemporal motion-energy filters to estimate image velocity, consonant with current views regarding the neurophysiology and psychophysics of motion perception. A parallel implementation computes a distributed representation of image velocity that encodes both a velocity estimate and the uncertainty in that estimate. In addition, a numerical measure of image flow uncertainty is derived. The egomotion model poses the detection of moving objects and the recovery of depth from motion as sensor fusion problems that necessitate combining information from different sensors in the presence of noise and uncertainty. Image sequences are segmented by finding image regions corresponding to entire objects that are moving differently from the stationary background. Dissert. Abstr.

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

A88-49821#
COST-FACTOR ANALYSIS OF PAYLOADS ON MANNED SPACE FLIGHTS [ANALYSE DES FACTEURS DE COUTS DES EXPERIENCES EMBARQUEES SUR VOL HABITE]
G. NAJA (ESA, Paris, France) and D. KAPLAN (Matra Espace, Velizy-Villacoublay, France) ESA Bulletin (ISSN 0376-4265), no. 54, May 1988, p. 30-33. In French.

A cost-factor analysis of the use of Doppler echocardiographs for monitoring astronaut cardiovascular functioning during manned space flights is presented based on data from the 1982 Salyut and 1985 Space Shuttle missions. The two missions are compared with respect to the effect of flight delays on costs, the astronaut's roles and training, and the significance of the science/industry/agency relationship. The impact of the study results for future mission preparation, the Columbus program,

documentation problems, and astronaut training are discussed. R.R.

A88-49935#
SOME HUMAN ASPECTS IN MAN-MACHINE SYSTEMS
YOSHIRO SAKAI Yamaguchi University, Faculty of Engineering, Memoirs (ISSN 0372-7661), vol. 38, March 1988, p. 39-44. In Japanese, with abstract in English.

A man-machine interface plays an important role in the whole of a man-machine system. Vagueness is one of the major problems in developing it, and involves various factors mainly caused by the human side - individual difference, skill, psychological effects, etc. Clues to some of these questions will be discussed, employing the results of experiments arranged under the hypotheses proposed by the author. Author

A88-50200#
DEVELOPMENT OF A GRAPHIC SIMULATOR AUGMENTED TELEOPERATION SYSTEM FOR SPACE APPLICATIONS
K. MACHIDA, Y. TODA, T. IWATA (Ministry of International Trade and Industry, Electrotechnical Laboratory, Tsukuba, Japan), M. KAWACHI, and T. NAKAMURA (Mitsubishi Electric Corp., Tokyo, Japan) IN: AIAA Guidance, Navigation and Control Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 358-364. refs
(AIAA PAPER 88-4095)

A teleoperation system augmented by a real time graphic simulator is proposed for efficient operation of a space teleoperator or telerobot, and is developed. An operator teaches the task sequences to a slave arm by driving the three dimensional graphic image of the arm on the simulator display, using an actual master arm. The sequences are stored and edited interactively, then the modified trajectories are transmitted to the slave arm. The flexible operation is realized by forward/reverse reproduction of variable time rate either on-line or off-line to the slave arm. In the simulator, the arm motion and interaction including the interference check and reconfiguration of primitives are computed in real-time, and the animation and the pseudoforce are fed back to an operator. This simulator is integrated with a slave manipulator system with the durability in vacuum environment and a master manipulator system with a universal hand-controller for space applications. Author

A88-50223*# Case Western Reserve Univ., Cleveland, Ohio.
REDUNDANT MANIPULATORS FOR MOMENTUM COMPENSATION IN A MICRO-GRAVITY ENVIRONMENT
R. D. QUINN, J. L. CHEN (Case Western Reserve University, Cleveland, OH), and C. LAWRENCE (NASA, Lewis Research Center, Cleveland, OH) IN: AIAA Guidance, Navigation and Control Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 581-587. refs
(Contract NAG3-797)
(AIAA PAPER 88-4121)

This paper is concerned with the implementation and assessment of joint motion management strategies for kinematically redundant robotic manipulators operating in the micro-gravity environment of Space Station. These robots must be capable of conducting experiments and manufacturing processes without disturbing the micro-gravity environment through base reactions/motions. The redundant degrees of freedom of the manipulator permit the inverse kinematic problem to be solved simultaneously with the minimization of a cost function. The cost function in this case is the weighted sum of the squares of the base forces and moments and is minimized over discrete time segments. The Generalized Inverse Method and Rayleigh Ritz technique are used to solve the combined optimization/inverse kinematics problem. Numerical examples include various robotic configurations and degrees of manipulator redundancy. Author

A88-50577*# Sverdrup Technology, Inc., Middleburg Heights, Ohio.
EXPERIMENTAL INVESTIGATION OF CONTROL/DISPLAY AUGMENTATION EFFECTS IN A COMPENSATORY TRACKING TASK
SANJAY GARG (Sverdrup Technology, Inc., Middleburg Heights, OH) and DAVID K. SCHMIDT (Purdue University, West Lafayette, IN) IN: AIAA Atmospheric Flight Mechanics Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 1-11. refs
(Contract NAG4-1)
(AIAA PAPER 88-4325)

The effects of control/display augmentation on human performance and workload have been investigated for closed-loop, continuous-tracking tasks by a real-time, man-in-the-loop simulation study. The experimental results obtained indicate that only limited improvement in actual tracking performance is obtainable through display augmentation alone; with a very high level of display augmentation, tracking error will actually deteriorate. Tracking performance improves when status information is furnished for reasonable levels of display quickening; again, very high quickening levels lead to tracking error deterioration due to the incompatibility between the status information and the quickened signal. O.C.

A88-50578*# Systems Technology, Inc., Hawthorne, Calif.
EFFECT OF MANIPULATOR AND FEEL SYSTEM CHARACTERISTICS ON PILOT PERFORMANCE IN ROLL TRACKING
BIMAL L. APONSO and DONALD E. JOHNSTON (Systems Technology, Inc., Hawthorne, CA) IN: AIAA Atmospheric Flight Mechanics Conference, Minneapolis, MN, Aug. 15-17, 1988, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 12-22. refs
(Contract NAS2-12221)
(AIAA PAPER 88-4326)

The control system features of force vs displacement stick command, feel/force displacement gradient, 'feel' system vs command prefilter dynamic lag, and flight control system effective time delay, have been investigated by a fixed-base simulation employing both joysticks and side-sticks in order to ascertain their effect on pilot opinion, pilot performance, and their hand/arm neuromuscular subsystem interaction. The results obtained indicate that the use of displacement sensing added the feel system dynamic lag to the command path and increased effective system flight delay, thereby lowering pilot opinion and performance but reducing the possibility of roll instability; the use of force sensing as stick command to exclude feel system dynamic lag had the obverse effect. O.C.

A88-50945
APPLYING ELECTRO-TACTILE DISPLAY TECHNOLOGY TO FIGHTER AIRCRAFT - FLYING WITH FEELING AGAIN
MORRIS A. ZLOTNIK (Northrop Corp., Aircraft Div., Hawthorne, CA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1988, p. 191-197. refs

The author's objective was to identify alternative cockpit display media which allow fighter pilots to receive flight-critical data in an Åeyes-out' mode, without dependency on the already overloaded auditory and visual senses. An intra-cockpit communication system based on the tactile/cutaneous sense is considered. If, for example, airspeed or angle-of-attack (AOA) data can be reliably communicated to the pilot through a cutaneous tactile stimulation device, the pilot could be constantly aware of his energy state without coming into the cockpit to read his displays. A method of information presentation based on electrotactile stimulation of the sense of touch is discussed. I.E.

A88-50968
AIRCRAFT SIDE HAND CONTROLLERS - WHERE TO FROM HERE?

C. E. WYLLIE IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1988, p. 454-460. refs

Current side hand controllers are passive fly-by-wire devices with two or three control axes, usually associated with a spartan armrest. Alternatives are considered for biomechanical interface improvements before moving to serial implementation of actuation for smart-stick multiaccess multiaxis controllers. Possible improvements are proposed to provide harmonious, smart-active hand controllers for future high-performance applications. It is suggested these must be based on an optimum biomechanical man-machine interface before the advantages of active control can be realized. I.E.

A88-50998
HUMAN FACTORS ANALYSIS OF EXTRAVEHICULAR SERVICING OF PAYLOADS WITHIN THE SPACE STATION SERVICING FACILITY

RAY A. REAUX, REBECCA L. SHANNON, and SYLVIA B. SHEPPARD (Computer Technology Associates, Inc., McLean, VA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 784-788. refs

A series of studies on extravehicular (EV) servicing of payloads was performed for the space station on-orbit assembly, maintenance, and servicing project at Goddard Space Flight Center (GSFC). The studies covered three types of servicing that could be performed in the space station servicing facility: change-out of orbital replacement units (ORUs), on-orbit assembly, and fluid replenishment. Servicing activities were decomposed into functions, subfunctions, and tasks. The tasks were allocated to EV, intravehicular (IV), and ground personnel. The temporal flow of the tasks was described using the computer-human operational requirements analysis system (CHORAS), an inhouse graphic tool that models the role of the human operator in a complex system. Once tasks were defined, detailed analyses were performed to identify the cognitive, sensory, and motor skills, information (data flows), and equipment needed to perform each task. The results of the studies include: a detailed operations concept for space station-based payload servicing, work performance issues, and design recommendations for procedures, equipment, and performance aids. In particular, recommendations for the design of the space station servicing facility and related servicing equipment were specified. I.E.

A88-50999
SITUATION AWARENESS GLOBAL ASSESSEMENT TECHNIQUE (SAGAT)

MICA R. ENDSLEY (Northrop Corp., Aircraft Div., Hawthorne, CA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 789-795. refs

Pilot-vehicle interface designs must be driven by the goal of establishing and maintaining high pilot situation awareness. The situation-awareness global assessment technique (SAGAT), developed to assist in this process by providing an objective measure of a pilot's situation awareness with any given aircraft design, is described. SAGAT is considered to represent a substantial improvement in the evaluation of pilot-vehicle interface designs, facilitating the development of cockpits which assist the pilot in surviving combat. A formal definition of situation awareness is presented a description of the SAGAT methodology and a discussion of its validation. I.E.

A88-51000
IMPROVING THE FIELD OF VIEW FOR THE NEXT GENERATION OF U.S. ARMY BLACK HAWK HELICOPTERS

ROBERT SIMON and DENNIS DUNN (Dynamics Research Corp., Wilmington, MA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 796-802.

The results of a study pertaining to the field-of-view (FOV) of the US Army UH-60A Black Hawk helicopter are presented. The study involved a comprehensive review of Army requirement documents, existing FOV studies, and accident data. Close attention was given to the dynamic flight characteristics that affect FOV. The study team collected technical data related to rotary wing aircraft design, in general, and the UH-60A design, in particular; conducted a survey of UH-60A pilots; and interviewed users and other technical experts. The study revealed that the current UH-60A design meets the requirements of MIL-STD 850B under static conditions. The only exception is the obstructed view that the door and windshield vertical structures create. However, under dynamic conditions the UH-60A design and normal flight characteristics substantially reduce the FOV in critical areas. Eleven options are identified that can improve and/or enhance the next-generation Black Hawk's FOV if incorporated into the design. Each option is presented and discussed. I.E.

A88-51001
THE USE OF PREDICTIVE MODELS FOR THE EARLY ASSESSMENT OF CREW STATION DESIGN UTILITIES

ANTHONY P. CIAVARELLI (Cubic Corp., San Diego, CA) and KEVIN M. SMITH IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 804-818. refs

A number of highly structured, tightly linked predictive models for the definition and design of higher-order functionally integrated tactical systems is presented. These models are particularly useful in evaluating system-wide attributes as part of the crew-station design and synthesis task, thus providing a mechanism for the early assessment of crew-station design utilities. Some results of applying these models to an advanced tactical program are discussed. I.E.

A88-51002* Army Aviation Systems Command, Moffett Field, Calif.
COMPUTATIONAL HUMAN FACTORS IN HUMAN-MACHINE ENGINEERING - THE ARMY-NASA AIRCREW/AIRCRAFT INTEGRATION (A3I) PROGRAM

E. JAMES HARTZELL (U.S. Army, Aeroflightdynamics Directorate, Moffett Field, CA) and STEPHEN LAKOWSKE (Sterling Software, Palo Alto, CA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 819-822. refs
(Contract NAS2-11555)

The A3I program is a joint US Army-NASA exploratory program to develop a rational predictive methodology for helicopter cockpit system design, including mission requirements and training-system implications, that integrates human factors engineering with other vehicle system design disciplines at an early stage in the development process. The program will produce a prototye human factors/computer-aided engineering (HF/CAE) workstation suite for use by design professionals. This interactive environment will include computational and expert systems for the analysis and estimation of the impact of cockpit design and mission specification on system performance by considering the performance consequences from the human component of the system, especially as an integral part of the overall system operation, and from the very beginning of the design process. The central issues of pilot workload, performance, and training needs, and appropriate uses of automation are interrelated to affect all integrated design considerations in future man-machine systems. The goal is to aid designers in understanding these complex interactions and in optimally matching human capabilities with advanced cockpit systems. I.E.

A88-51003
C-SAINT: A SIMULATION MODELING TOOL CUSTOMIZED FOR WORKLOAD AND INFORMATION FLOW ANALYSIS
CONSTANCE M. HOYLAND, DEBORAH GANOTE, and GERALD P. CHUBB (SofTech, Inc., Fairborn, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 823-830. refs
(Contract F33615-87-C-0537)

C-SAINT is a customized version of the Fortran-based simulation language SAINT (Systems Analysis of Integrated Networks of Tasks) for modeling large, complex systems (Seifert and Chubb, 1978). C-SAINT is formally presented, and how it will facilitate workload and information analysis tool development for the cockpit automation technology (CAT) program is described. C-SAINT includes several modifications to SAINT that improve its abilities to represent branching processes and to dynamically allocate resources to activities. Two additional output files are generated, and modifications have been made to the content of the detailed iteration report. Potential applications are briefly described, specifically, analysis of modified Petri nets and adaptive network analysis. I.E.

A88-51004#
RULES FOR FIGHTER COCKPIT AUTOMATION
JOE W. MCDANIEL (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 831-838. refs

The issues and special problems associated with the automation of functions in the fighter aircraft cockpit are discussed. The fighter cockpit has particular design requirements resulting from the critical need to function in a combat. Digital avionics permit additional capability, but at a cost of additional workload for the pilot and perhaps even lower reliability and operability. Automation is increasingly seen as the solution to this problem. Automation is defined on a continuum with ten generic levels of delegated functionality. The higher levels are more appropriate for highly reliable, low-criticality functions. Sixteen rules for automation of fighter cockpits are presented and discussed. These rules considered preliminary, are presented as a framework for a systematic approach to the automation design problem. I.E.

A88-51005
AUTOMATION AND DYNAMIC ALLOCATION: ENGINEERING ISSUES AND APPROACHES
RANDY BOYS and KATHERINE PALKO (Texas Instruments, Inc., Defense Systems and Electronics Group, Dallas) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 850-855. refs

The issues of cockpit automation, types of automation, and task allocation (including dynamic allocation) are discussed in regard to the near future of the single-seat tactical aircraft. The application of these considerations to the development of a prototype 'electronic crewmember' is described. Examples of the formal steps taken in the task-analysis process that directed subsequent hardware and software engineering are included. Some of the more significant tradeoffs required by the incorporation of dynamic allocation into the capabilities of the electronic crewmember are addressed. I.E.

A88-51006
HUMANE: A KNOWLEDGE-BASED SIMULATION ENVIRONMENT FOR HUMAN-MACHINE FUNCTION ALLOCATION
AZAD M. MADNI (Perceptronics, Inc., Woodland Hills, CA) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 860-866. Research supported by Perceptronics, Inc. refs
(Contract F33615-86-C-0536)

The human-machine allocation network-based environment (HUMANE), a designer-oriented knowledge-based simulation environment for analyzing function-allocation options, is presented. The requirements for a designer-oriented function allocation tool are presented, followed by the design methodology, overall concept of operation, hardware-software implementation, potential enhancements and transfer strategy. HUMANE both systematizes and formalizes the function allocation process. Its Åwhat-if' simulation-based analysis capability produces dramatic savings in designers' time-on-task while comprehensively covering performance and workload envelopes. The knowledge-based implementation makes the software inspectable, maintainable and modular. Its graphical interfaces are both easy-to-use. HUMANE allows the designer to save both selected and rejected Function-allocation options (along with a brief reason) in the lessons-learned data bases. This feature offers great utility in subsequent analysis of other platforms and systems. I.E.

A88-51007
DESIGN AND ANALYSIS OF A CLOSED-LOOP CONTROLLER FOR AN ANTI-G SUIT
KHALID W. BARAZANJI, KULDIP S. RATTAN (Wright State University, Dayton, OH), and DANIEL W. REPPERGER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 868-873. Research supported by Universal Energy Systems, Inc. and Wright State University. refs
(Contract F49620-85-C-0013)

A closed-loop controller for an existing anti-G suit is proposed. The objective of this controller is to improve the G-tolerance of the pilot by filling the anti-G-suit bladders to the desired pressure in a short time period and with a small overshoot. This controller was added to the MATRIXx-based computer simulation of the cardiovascular system to evaluate its performance for different G-profiles. A comparison with the high-flow valve and the so called Bang-Bang servo valve, and the simulation results showing the effects of time delay between inflation of anti-G-suit bladders are presented. A discrete equivalent of this controller was obtained for implementation on a microprocessor. I.E.

A88-51010#
DEVELOPMENT OF AN OXYGEN MASK INTEGRATED ARTERIAL OXYGEN SATURATION (SAO2) MONITORING SYSTEM FOR PILOT PROTECTION IN ADVANCED FIGHTER AIRCRAFT
LLOYD D. TRIPP and WILLIAM B. ALBERY (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 885-888. refs

A smart O2 mask that accurately tracks the vital signs of its wearer is presented. Because the sensors are integrated in the nose bridge of the standard 12-P oxygen mask, and the sensor leads can be incorporated into the microphone leads and jack coming from the mask, the system is completely blind to the pilot. The nasal sensor consists of two LED's and a photocell mounted in adhesive tape, allowing direct, nonslip mounting on skin; it does not require arterialized blood for operation. Instead, it used two wavelengths of light at 660 and 940 nm and an integrated microprocessor-based computer program to measure arteriolar-blood pulsations. The pulsatile flow creates a transient change in the light path, modifying the amount of light received by the photocell. Thus, the oximeter combines measurement of the different light transmission characteristics of oxyhemoglobin and deoxyhemoglobin with the arterial-pulse detection principle used by plethysmographs to compute arterial oxygen saturation.

The device compares accurately with blood cuvette and other methods of measuring SaO2. I.E.

A88-51013
A HUMAN FACTORS EVALUATION OF THE VISUAL SYSTEM COMPONENT DEVELOPMENT PROGRAM (VSCDP) EYE-TRACKING SYSTEM
JEROME I. NADEL (Kansas State University, Manhattan) and HAROLD D. WARNER (Dayton, University, Williams AFB, AZ) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 915-917.
(Contract F49620-85-C-0013; F33615-84-C-0066)

Results of a qualitative human factors evaluation, conducted to identify the user, equipment, and environmental factors that impaired the performance of the visual system component development program (VSCDP) eye-tracking system, are presented. The evaluation was performed in two phases: an exploratory phase and a validation phase. The results of the first phase indicated that eye tracking performance directly related to pupil size. In the second phase, the eyes of two subjects were chemically dilated, and a profound improvement in eye-tracking performance was observed. I.E.

A88-51014#
HEAD-UP DISPLAY SYMBOLOGY FOR UNUSUAL ATTITUDE RECOVERY
JOHN REISING, JOHN ZENYUH, and KRISTEN BARTHELEMY (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1988, p. 926-930.

One purpose of head-up displays (HUDs) in modern fighter aircraft is to provide the pilot with attitude information while allowing the pilot to focus attention outside the cockpit. However, current attitude symbology is deficient in its ability to answer important pilot questions about unusual-attitude recovery. Results of a study to evaluate several advanced symbology concepts designed to resolve these deficiencies are reported. The results indicate that the inclusion of multicolor coding and a fixed point of rotation for the dynamic pitch-ladder symbology results in better unusual-attitude recovery. I.E.

A88-51046
RESOURCE MEASUREMENT USING A CLOSED-LOOP EEG CONTROL SYSTEM
ANDREW M. JUNKER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), DAVID F. INGLE, JOHN H. SCHNURER, and CRAIG W. DOWNEY (Systems Research Laboratories, Inc., Dayton, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1988, p. 1519-1522. refs

A technique of conscious control of one's EEG (electroencephalogram) resonance was tested for potential use as an indication of mental resource allocation. An experimental paradigm was developed which incorporated this technique and a number of tasks from the Criterion Task Set (CTS). The objective was to determine if the ability to consciously control EEG resonance varied in a systematic fashion based on the type of CTS task being performed (i.e., different mental resources being tapped). An experimental setup, including a lock-in amplifier system (LAS) and the CTS, was developed. Subjects were trained in loop-closure performance at chosen EEG frequencies. Trained subjects then attempted loop-closure while performing CTS tasks. Experimental methods and preliminary results are addressed. I.E.

A88-51047
LOOP-CLOSURE OF THE VISUAL-CORTICAL RESPONSE
ANDREW M. JUNKER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), CRAIG W. DOWNEY, JOHN H. SCHNURER, and DAVID F. INGLE (Systems Research Laboratories, Inc., Dayton, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1988, p. 1523-1529. refs

Results of a study designed to test the effectiveness of using feedback to consciously connect humans to their evoked response and thereby Åclose the loop' around the brain are presented. A technique to achieve loop closure using a lock-in amplifier approach is presented. Findings indicate that conscious control of EEG (electroencephalogram) is possible. Each of the eight subjects tested was able to achieve control. Implications of these results in terms of brain-actuated control are addressed. I.E.

A88-51048
A REAL TIME FREQUENCY ANALYSIS METHODOLOGY FOR EVOKED POTENTIAL LOOP-CLOSURE
JOHN H. SCHNURER, DAVID F. INGLE, CRAIG W. DOWNEY (Systems Research Laboratories, Inc., Dayton, OH), and ANDREW M. JUNKER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 88; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 23-27, 1988. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1988, p. 1530-1535. refs

Evoked EEG (electroencephalogram) response research indicates the potential for a usable brain-actuated control system (UBACS). Reduction of time lag is essential for the continued development of a subject-training system, which has yielded results, but has certain limitations in the areas of response time and false feedback due to artifacts. The authors are presently investigating a lock-in amplifier system (LAS) to overcome these limitations. Frequency and phase facile system capabilities as well as artifact rejection techniques are being developed for the LAS. Improved LAS response time is projected. It is expected that this tool will enable effective training by continuously supplying subjects with an indication of their EEG output at a reference frequency. The experimental/prototype system is discussed. I.E.

N88-27700# Royal Army Medical Coll., London (England).
CAN CNV AMPLITUDE PREDICT ABILITY TO ACCOMPLISH A DEMANDING TASK?
PETER ABRAHAM *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 2 p Feb. 1988
Avail: NTIS HC A18/MF A01

Increased Contingent Negative Variation (CNV) was related to attention, effort, and quick response to stimuli, while decreased CNV amplitude was related to distraction, delayed reaction times, and disorder of mental or emotional functioning. These observations suggest that CNV amplitude measured in the laboratory might be a useful predictor of an individual's ability to accomplish a demanding sensorimotor task under operational conditions. One such task is the operation of a surface-to-air missile known as Blowpipe. Firing this weapon requires rapid responses to that information, under stressful conditions. It also requires auditory stimuli emanating from the weapon. Thus firing operation is not unlike a CNV-generating situation. The Blowpipe training program afforded an opportunity to test the usefulness of CNV measurement for predicting operational performance as assessed during the firing of real missiles on a testing range. It was hypothesized that low laboratory CNV amplitude would predict unsuccessful Blowpipe firing and vice versa. The CNV amplitude was measured in 75 soldiers engaged in training as missile operators. Sixty-nine subjects completed the qualifying course and fired real missiles. Those who showed poor firing performance had CNV amplitudes at the extremes of the range. Selection strategies are discussed.
Author

N88-27704# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
FIGHTER PILOT PERFORMANCE DURING AIRBORNE AND SIMULATOR MISSIONS: PHYSIOLOGICAL COMPARISONS
JUNE J. SKELLY, BRADLEY PURVIS, and GLENN WILSON *In* AGARD, Electric and Magnetic Activity of the Central Nervous System: Research and Clinical Applications in Aerospace Medicine 16 p Feb. 1988
Avail: NTIS HC A18/MF A01

The growing importance of simulators for training, research, and certification focuses attention on how little is known about whether the behavioral outcomes obtained in a simulator really represent the operational situation. The research addresses this issue, and proposes that use of physiological measures to examine the correspondence between pilot responses during actual missions and comparable simulated missions. Physiological measures of electrical brain activity, heart rate, and eye movements were taken while pilots flow tactical training missions in both the A-7 aircraft and simulator. These measures did discriminate between: flight position (wing vs lead); actual and simulated flight; type of mission event (e.g., takeoff, maneuvers, weapons delivery), and individual pilots. Author

N88-27749# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
ENGINEERING DATA COMPENDIUM. HUMAN PERCEPTION AND PERFORMANCE. USER'S GUIDE
KENNETH R. BOFF, ed. and JANET E. LINCOLN, ed. (Dayton Univ., Ohio.) 1988 142 p
(LC-87-19560) Avail: NTIS HC A07/MF A01 CSCL 05H

The concept underlying the Engineering Data Compendium was the product of a research and development program (Integrated Perceptual Information for Designers project) aimed at facilitating the application of basic research findings in human performance to the design and military crew systems. The principal objective was to develop a workable strategy for: (1) identifying and distilling information of potential value to system design from the existing research literature, and (2) presenting this technical information in a way that would aid its accessibility, interpretability, and applicability by systems designers. The present four volumes of the Engineering Data Compendium represent the first implementation of this strategy. This is the first volume, the User's Guide, containing a description of the program and instructions for its use. F.M.R.

N88-27750# Lawrence Livermore National Lab., Calif.
THE ASSESSMENT OF HUMAN/COMPUTER PERFORMANCE USING HUMAN PRODUCTIVITY MEASURES: MIPS AND BIPS ARE MEGAFLOPS
W. W. BANKS, E. B. SCHULTZ, E. CRANE, and M. RILEY 23 Jul. 1987 17 p Presented at the Computer Human Interaction Conference, Washington, D.C., 15 May 1988 Prepared in cooperation with Air Force Logistics Command, Wright-Patterson AFB, Ohio
(Contract W-7405-ENG-48)
(DE87-013491; UCRL-97113; CONF-880516-1) Avail: NTIS HC A03/MF A01

Multiple logistics processing systems were evaluated using human productivity measures. Comparisons were made to determine which system produced; greater savings in task execution time/errors; minimal task steps; and provided users with the greatest degree of connectivity and error feed back. Multiple assessment methods including interviews, deterministic analysis, and statistical inferential testing were used. Results indicated the superiority of gateway processors and the multiple methods approach. Traditional hardware bench-marking assessments topically omit the user, leaving ambiguous results and severe predictive validity limits. Benefits derived from including the human component, include greater levels of predictive validity and causality determinates. DOE

N88-27751# Naval Ocean Systems Center, San Diego, Calif.
ASSESSMENTS OF MANEUVERABILITY WITH THE TELEOPERATED VEHICLE (TOV)
EDWARD H. SPAIN Jan. 1988 32 p Presented at the AUVS Symposium, Washington, D.C., 19-21 Jul. 1987
(AD-A191584) Avail: NTIS HC A03/MF A01 CSCL 05H

The Naval Ocean Systems Center's Hawaii Laboratory is undertaking a program to develop airborne remotely operated devices (ARODs) and teleoperated land vehicles (TOVs) that will be delivered to the U.S. Marine Crops for field assessments of the applicability and effectiveness of such vehicles for reconnaissance and combat in tactical environments. An essential component of both remotely operated systems is a visual sensor suite and helmet operated display that allows an operator to view the remote scene in a familiar, natural fashion well enough to drive the TOV safely and reliably across unfamiliar terrain. In order to facilitate the development of this mobility sensor system, a field testing program was established in which alternate mobility viewing system options are being objectively compared with regard to their impact on maneuverability. The procedures and specific tasks used in making comparisons of maneuverability across the various viewing system options tested are described. Specific results in the terms of times through courses, steering, and braking accuracy are reported. Author

N88-27752# Transportation Systems Center, Cambridge, Mass.
COCKPIT AND CABIN CREW COORDINATION Final Report, Oct. - Nov. 1985
KIM M. CARDOSI and M. S. HUNTLEY, JR. Feb. 1988 72 p
(AD-A192445; DOT-TSC-FAA-87-4; FAA-FS-88/1) Avail: NTIS HC A04/MF A01 CSCL 05H

Cockpit and cabin crew coordination is crucial not only in emergencies, but also during normal operations. The purposes of this study were to determine the status of crew coordination in the industry and to identify the implications for flight safety. This examination of crew coordination included: an examination of accidents and incidents in which cockpit and cabin crew coordination was a factor, an analysis of the results of surveys of pilot and flight attendant safety representatives, a survey of manuals and training programs for flight attendants and pilots, interviews with training administrators from seven Part 121 carriers, and interviews with Principal Operations Inspectors and their managers. Problem areas identified in this study included: inadequate crew communication in emergencies, confusion over the sterile cockpit (FAR 121.542) concept, inadequate instruction on the duties of the other crew in training, failure to properly secure the cabin for takeoff and landing, and inadequate support for and staffing of the FAA inspector workforce. Recommendations for improving the status of cockpit and cabin crew coordination include changes in training and operational procedures. GRA

N88-27753# Midwest Systems Research, Inc., Dayton, Ohio.
A COCKPIT NATURAL LANGUAGE STUDY: VOCABULARY AND GRAMMAR ANALYSES Final Report, Oct. 1986 - Sep. 1987
MICHAEL P. MUNGER, RONALD L. SMALL, and DAVID T. WILLIAMSON Feb. 1988 69 p
(Contract F33615-85-C-3623)
(AD-A193289; AFWAL-TR-87-3108) Avail: NTIS HC A04/MF A01 CSCL 05G

This report describes recent work which was conducted to facilitate research and development efforts in the use of voice interaction in fighter cockpits. Definitions of an operational vocabulary and grammar are starting points for studying the use of voice interaction in fighter cockpits. This report provides an initial definition of a vocabulary, based on a Pilot's Associate equipped fighter. It also provides software tools for vocabulary, and grammar analysis. Researchers in this area need such tools to adapt quickly to changing technologies as they are applied to cockpits, with consequent changes to vocabulary and grammars. These software tools (1) assist in processing a vocabulary into a lexicon for use by parsers, (2) assist in developing grammars for

parsers, and (3) assist in determining semantics from parsers steps. GRA

N88-27754*# Life Systems, Inc., Cleveland, Ohio.
ADVANCED EMU ELECTROCHEMICALLY REGENERABLE CO2 AND MOISTURE ABSORBER MODULE BREADBOARD Final Report
M. C. LEE, M. SUDAR, and B. J. CHANG Feb. 1988 124 p
(Contract NAS9-17307)
(NASA-CR-172054; NAS 1.26:172054; LSI-TR-769-4) Avail: NTIS HC A06/MF A01 CSCL 06K

The applicability of the Electrochemically Regenerable Carbon Dioxide and Moisture Absorption Technology to the advanced extravehicular mobility unit was demonstrated by designing, fabricating, and testing a breadboard Absorber Module and an Electrochemical Regenerator. Test results indicated that the absorber module meets or exceeds the carbon dioxide removal requirements specified for the design and can meet the moisture removal requirement when proper cooling is provided. CO2 concentration in the vent gas stream was reduced from 0.52 to 0.027 kPa (3.9 to 0.20 mm Hg) for the full five hour test period. Vent gas dew point was reduced from inlet values of 294 K (69 F) to 278 K (41 F) at the outlet. The regeneration of expended absorbent was achieved by the electrochemical method employed in the testing. An absorbent bed using microporous hydrophobic membrane sheets with circulating absorbent is shown to be the best approach to the design of an Absorber Module based on sizing and performance. Absorber Module safety design, comparison of various absorbents and their characteristics, moisture absorption and cooling study and subsystem design and operation time-lining study were also performed. Author

N88-27755*# Life Systems, Inc., Cleveland, Ohio.
VAPOR COMPRESSION DISTILLATION SUBSYSTEM (VCDS) COMPONENT ENHANCEMENT, TESTING AND EXPERT FAULT DIAGNOSTICS DEVELOPMENT, VOLUME 2 Final Report
E. S. MALLINAK Dec. 1987 75 p
(Contract NAS9-16374)
(NASA-CR-172076; NAS 1.26:172076; LSI-TR-471-26-VOL-2)
Avail: NTIS HC A04/MF A01 CSCL 06K

A wide variety of Space Station functions will be managed via computerized controls. Many of these functions are at the same time very complex and very critical to the operation of the Space Station. The Environmental Control and Life Support System is one group of very complex and critical subsystems which directly affects the ability of the crew to perform their mission. Failure of the Environmental Control and Life Support Subsystems are to be avoided and, in the event of failure, repair must be effected as rapidly as possible. Due to the complex and diverse nature of the subsystems, it is not possible to train the Space Station crew to be experts in the operation of all of the subsystems. By applying the concepts of computer-based expert systems, it may be possible to provide the necessary expertise for these subsystems in dedicated controllers. In this way, an expert system could avoid failures and extend the operating time of the subsystems even in the event of failure of some components, and could reduce the time to repair by being able to pinpoint the cause of a failure when one cannot be avoided. Author

N88-28630# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
ENGINEERING DATA COMPENDIUM. HUMAN PERCEPTION AND PERFORMANCE, VOLUME 1
KENNETH R. BOFF, ed. and JANET E. LINCOLN, ed. (Dayton Univ., Ohio.) 1988 923 p
(LC-87-19560) Avail: NTIS HC A99/MF E03 CSCL 05H

The concept underlying the Engineering Data Compendium was the product an R and D program (Integrated Perceptual Information for Designers project) aimed at facilitating the application of basic research findings in human performance to the design of military crew systems. The principal objective was to develop a workable strategy for: (1) identifying and distilling information of potential value to system design from existing research literature, and (2) presenting this technical information in a way that would aid its accessibility, interpretability, and applicability by system designers. The present four volumes of the Engineering Data Compendium represent the first implementation of this strategy. This is Volume 1, containg sections on Visual Acquisition of Information, Auditory Acquisition of Information, and Acquisition of Information by Other Senses. F.M.R.

N88-28631# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
ENGINEERING DATA COMPENDIUM. HUMAN PERCEPTION AND PERFORMANCE, VOLUME 2
KENNETH R. BOFF, ed. and JANET E. LINCOLN, ed. (Dayton Univ., Ohio.) 1988 977 p
(LC-87-19560) Avail: NTIS HC A99/MF E04 CSCL 05H

The concept underlying the Engineering Data Compendium was the product of a Research and Development program (Integrated Perceptual Information for Designers project) aimed at facilitating the application of basic research findings in human performance to the design of military crew systems. The principal objective was to develop a workable strategy for: (1) identifying and distilling information of potential value to system design from existing research literature, and (2) presenting this technical information in a way that would aid its accessibility, interpretability, and applicability by system designers. The present volumes of the Engineering Data Compendium represent the first implementation of this strategy. This is Volume 2, which contains sections on Information Storage and Retrieval, Spatial Awareness, Perceptual Organization, and Attention and Allocation of Resources. F.M.R.

N88-28632# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.
ENGINEERING DATA COMPENDIUM. HUMAN PERCEPTION AND PERFORMANCE, VOLUME 3
KENNETH R. BOFF, ed. and JANET E. LINCOLN, ed. (Dayton Univ., Ohio.) 1988 860 p
(LC-87-19560) Avail: NTIS HC A99/MF E03 CSCL 05H

The concept underlying the Engineering Data Compendium was the product of a research and development program (Integrated Perceptual Information for Designers project) aimed at facilitating the application of basic research findings in human performance to the design of military crew systems. The principal objective was to develop a workable strategy for: (1) identifying and distilling information of potential value to system design from existing research literature, and (2) presenting this technical information in a way that would aid its accessibility, interpretability, and applicability by system designers. The present four volumes of the Engineering Data Compendium represent the first implementation of this strategy. This is Volume 3, containing sections on Human Language Processing, Operator Motion Control, Effects of Environmental Stressors, Display Interfaces, and Control Interfaces (Real/Virtual). F.M.R.

N88-28633*# Life Systems, Inc., Cleveland, Ohio.
ADVANCEMENTS IN OXYGEN GENERATION AND HUMIDITY CONTROL BY WATER VAPOR ELECTROLYSIS Final Report
D. B. HEPPNER, M. SUDAR, and M. C. LEE Jun. 1988 81 p
(Contract NAS9-17558)
(NASA-CR-172073; NAS 1.26:172073; LSI-TR-919-4A) Avail: NTIS HC A05/MF A01 CSCL 05H

Regenerative processes for the revitalization of manned spacecraft atmospheres or other manned habitats are essential for realization of long-term space missions. These processes include oxygen generation through water electrolysis. One promising technique of water electrolysis is the direct conversion of the water vapor contained in the cabin air to oxygen. This technique is the subject of the present program on water vapor electrolysis development. The objectives were to incorporate technology improvements developed under other similar electrochemical programs and add new ones; design and fabricate a mutli-cell electrochemical module and a testing facility; and demonstrate through testing the improvements. Each aspect of the water vapor electrolysis cell was reviewed. The materials of

construction and sizing of each element were investigated analytically and sometime experimentally. In addition, operational considerations such as temperature control in response to inlet conditions were investigated. Three specific quantitative goals were established. Author

N88-28634*# Life Systems, Inc., Cleveland, Ohio.
VAPOR COMPRESSION DISTILLATION SUBSYSTEM (VCDS) COMPONENT ENHANCEMENT, TESTING AND EXPERT FAULT DIAGNOSTICS DEVELOPMENT, VOLUME 1 Final Report
L. S. KOVACH and E. M. ZDANKIEWICZ Dec. 1987 90 p
(Contract NAS9-16374)
(NASA-CR-172072; NAS 1.26:172072; LSI-TR-471-26-VOL-1)
Avail: NTIS HC A05/MF A01 CSCL 06K

Vapor compression distillation technology for phase change recovery of potable water from wastewater has evolved as a technically mature approach for use aboard the Space Station. A program to parametrically test an advanced preprototype Vapor Compression Distillation Subsystem (VCDS) was completed during 1985 and 1986. In parallel with parametric testing, a hardware improvement program was initiated to test the feasibility of incorporating several key improvements into the advanced preprototype VCDS following initial parametric tests. Specific areas of improvement included long-life, self-lubricated bearings, a lightweight, highly-efficient compressor, and a long-life magnetic drive. With the exception of the self-lubricated bearings, these improvements are incorporated. The advanced preprototype VCDS was designed to reclaim 95 percent of the available wastewater at a nominal water recovery rate of 1.36 kg/h achieved at a solids concentration of 2.3 percent and 308 K condenser temperature. While this performance was maintained for the initial testing, a 300 percent improvement in water production rate with a corresponding lower specific energy was achieved following incorporation of the improvements. Testing involved the characterization of key VCDS performance factors as a function of recycle loop solids concentration, distillation unit temperature and fluids pump speed. The objective of this effort was to expand the VCDS data base to enable defining optimum performance characteristics for flight hardware development. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

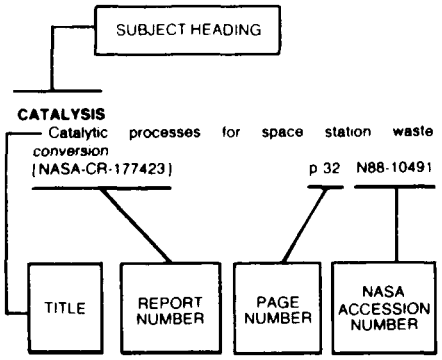
A88-51134
GATHERING EVIDENCE - THE CASE FOR PAST LIFE ON MARS
ROBERT A. WHARTON, JR. (Nevada, University, Reno) Space World (ISSN 0038-6332), vol. Y-9-297, Sept. 1988, p. 20-24.

The possibility that life may have existed on Mars up to 3 billion years ago is discussed. The search for fossils of microorganisms in rocks and the possibility that ice-covered lakes once existed on Mars are examined. Past and planned missions to Mars and the way in which research in Antarctica is important to the study of Mars are considered. R.B.

N88-28204*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NEW CCIR REPORT ON SETI
N. F. DEGROOT *In its* The Telecommunications and Data Acquisition Report p 280-291 15 May 1988
Avail: NTIS HC A15/MF A01 CSCL 03B

Since 1978, the reports and recommendations of the Comite Consultatif International des Radiocommunications (CCIR) have included a document describing SETI (the Search for Extraterrestrial Intelligence) in the context of radio frequency management. A new report to replace the old one was adopted by a CCIR study group; both reports were written at JPL. Following introductory and background material, the text of the new report is given. Author

Typical Subject Index Listing



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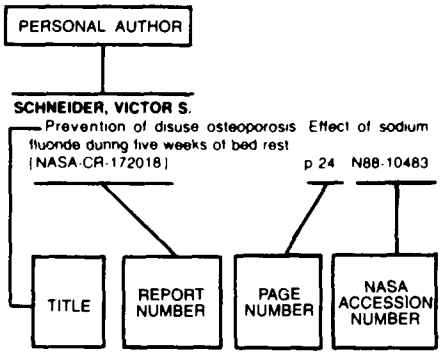
PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



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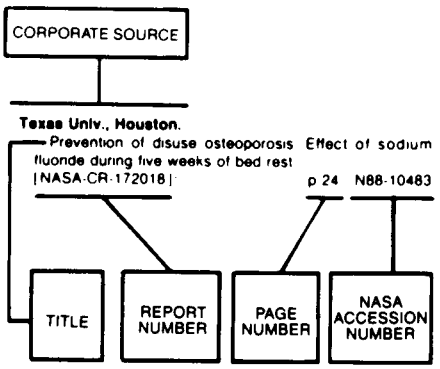
Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

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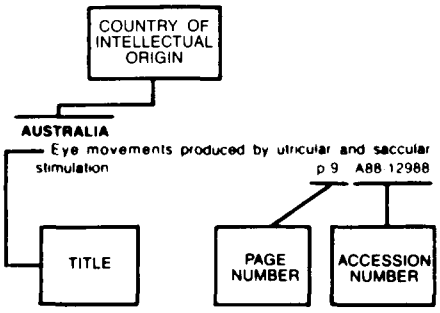

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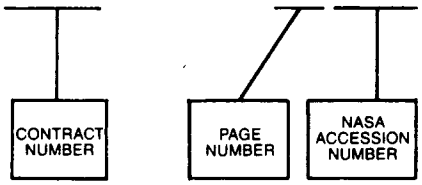

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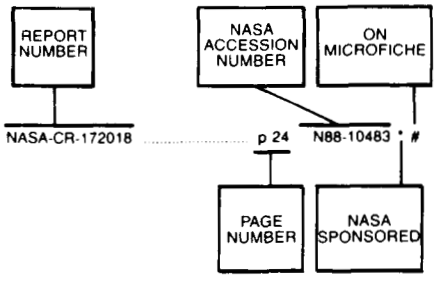

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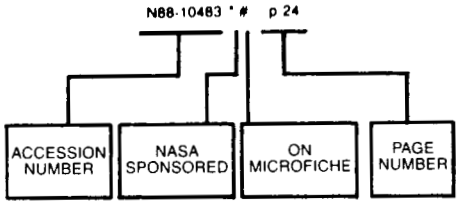

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