

NASA SP-7011 (394)  
November 1994

# AEROSPACE MEDICINE AND BIOLOGY

*P-41*

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(NASA-SP-7011(394)) AEROSPACE  
MEDICINE AND BIOLOGY: A CONTINUING  
BIBLIOGRAPHY WITH INDEXES  
(SUPPLEMENT 394) (NASA) 41 p

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NASA SP-7011 (394)  
November 1994

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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

1994

This publication was prepared by the NASA Center for AeroSpace Information,  
800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934, (301) 621-0390.

# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 71 reports, articles, and other documents recently announced in the NASA STI Database. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue include:

<i>Scientific and Technical Aerospace Reports (STAR)</i> (N-10000 Series)	N94-36520 — N94-37856
Open Literature (A-60000 Series)	A94-61274 — A94-62104

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

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

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

A cumulative index for 1994 will be published in early 1995.

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

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## TYPICAL REPORT CITATION AND ABSTRACT

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**ACCESSION NUMBER** → N94-11045\*#      Pennsylvania State Univ., Hershey. Coll. of ← **CORPORATE SOURCE**  
 Medicine.

**TITLE** → **EFFECTS OF CSF HORMONES AND IONIC COMPOSITION ON SALT/WATER METABOLISM** Final Technical Report, 1 Mar. 1981 - 31 Dec. 1992

**AUTHOR** → WALTER B. SEVERS      31 Dec. 1992      32 p      ← **PUBLICATION DATE**

**CONTRACT NUMBER** → (Contract NCC2-127)

**REPORT NUMBERS** → (NASA-CR-193232; NAS 1.26:193232)      Avail: CASI HC A03/MF ← **AVAILABILITY AND PRICE CODE**  
 A01

The consequences of headward fluid shifts during manned spaceflight was studied. Such shifts were recognized early by both U.S. and Soviet scientists because of signs and symptoms referable to the head. Some of these include disturbed vision, puffiness in the face and periorbital areas, headache, vestibular dysfunction, and distended jugular veins. We posited that the fluid shift had an immediate effect on the brain and a long-term action requiring a neural interpretation of the flight environment. This would re-adjust both efferent neural as well as hormonal mechanisms to sustain cardiovascular and fluid/electrolyte balance consonant with survival in microgravity. Work along these lines is summarized. A synopsis of some of the main research is presented. The following topics were studied: (1) angiotensin and vasopressin action in the central nervous system; (2) intracranial pressure control; (3) research on subcommissural organ; and (4) research on the eye.

Author (revised)

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**ACCESSION NUMBER** → A94-60203

**TITLE** → **ESTIMATION OF THE LOW-EARTH-ORBIT DEBRIS POPULATION AND DISTRIBUTION**

**AUTHORS** → KYLE T. ALFRIEND General Research Corp., VA and ← **AUTHORS' AFFILIATION**  
 D. LAURIE LEWIS *Journal of Spacecraft and Rockets* (ISSN 0022- ← **JOURNAL TITLE**  
 4650) vol. 31, no. 1 January-February 1994 p. 48-53 refs      ← **PUBLICATION DATE**

**REPORT NUMBER** → (BTN-94-EIX94311322893) Copyright

In this paper, an algorithm for estimating the low-Earth-orbit space object population and distribution from measurements taken by a vertical, staring narrow beam radar is developed and validated. The radar measures the altitude, inclination, and radar cross section of each object which passes through the beam. The effects of the assumptions made in developing the algorithm and measurement errors are discussed. An estimate of the operational time of the radar needed to achieve a specified accuracy in the space object population is also developed.

EI

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 394)*

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## LIFE SCIENCES (GENERAL)

**A94-61433**

### **NONLINEAR REFRACTION IN VITREOUS HUMOR**

BENJAMIN A. ROCKWELL Armstrong Lab., Brooks AFB, TX, W. P. ROACH, M. E. ROGERS, M. W. MAYO, and C. A. TOTH *Optics Letters* (ISSN 0146-9592) vol. 18, no. 21 November 1, 1993 p. 1792-1794 refs (BTN-94-EIX94321324129) Copyright

To determine the nonlinear refractive index ( $n_{\text{sub } 2}$ ) for human and rabbit vitreous humor, water, and physiological saline, the authors extend the application of the z-scan technique. There were nonlinear contributions to the measured signal from the aqueous samples and the quartz cell that held the sample in these measurements. With 60-ps pulses at 532 nm, measurements were made. This is the first measurement of the nonlinear refractive properties of biological material to the authors' knowledge. EI

**A94-61493**

### **STRUCTURAL BASIS OF SUPERANTIGEN ACTION INFERRED FROM CRYSTAL STRUCTURE OF TOXIC-SHOCK SYNDROME TOXIN-1**

K. RAVI ACHARYA Bath Univ., Bath (United Kingdom), EDWARD F. PASSALACQUA, E. YVONNE JONES, KARL HARLOS, DAVID I. STUART, ROSSALYN D. BREHM, and HOWARD S. TRANTER *Nature* (ISSN 0028-0836) vol. 367, no. 6458 January 6, 1994 p. 94-97 refs (BTN-94-EIX94311265683) Copyright

Superantigens stimulate T cells bearing particular T-cell receptor VBeta sequences, so they are extremely potent polyclonal T-cell mitogens. T-cell activation is preceded by binding of superantigens to class II major histocompatibility complex (MHC) molecules. To further the structural characterization of these interactions, the crystal structure of a toxin associated with toxic-shock syndrome, TSST-1, which is a microbial superantigen, has been determined at 2.5 Å resolution. The N- and C-terminal domains of the structure both contain regions involved in MHC class 2 association; the C-terminal domain is also implicated in binding the T-cell receptor. Despite low sequence conservation, the TSST-1 topology is similar to the structure reported for the superantigen staphylococcal enterotoxin B(sup 4). But TSST-1 lacks several of the structural features highlighted as central to superantigen activity in the staphylococcal enterotoxin B and we therefore reappraise the structural basis of superantigen action. EI

**A94-61599**

### **IN VIVO RETINAL IMAGING BY OPTICAL COHERENCE TOMOGRAPHY**

E. A. SWANSON Massachusetts Inst. of Tech., Lexington, MA, J. A. IZATT, M. R. HEE, D. HUANG, C. P. LIN, J. S. SCHUMAN, C. A. PULIAFITO, and J. G. FUJIMOTO *Optics Letters* (ISSN 0146-9592) vol. 18, no. 21 November 1, 1993 p. 1864-1869 refs (BTN-94-EIX94321324153) Copyright

The first in vivo measurements of human retinal structure with

optical coherence tomography are described to the authors knowledge. The highest depth resolution in vivo retinal images to date are represented by these images. The authors discuss the image-processing techniques, the tomographic system, and examples of high-resolution tomographs and their clinical relevances. EI

**A94-61743**

### **EFFECT OF MAGNETIC FIELDS ON VISCOUS LIQUID COLUMN WITH FINITE LENGTH IN A VERTICAL STRAIGHT TUBE**

GONGBI WEN Peking Univ., Beijing (China) and KELI SUN *Applied Mathematics and Mechanics (English Edition)* (ISSN 0253-4827) vol. 15, no. 3 March 1994 p. 247-258 refs (BTN-94-EIX94321333887) Copyright

The formation of thrombus is closely related to the hydrodynamical conditions. Chandler's experiment and further research showed that the cause of thrombus formed in the lower meniscus might be that the fluid particles at relatively high speed struck on the lower meniscus leading to the gathering of platelet and red blood cells (RBC). The motion of viscous liquid column with finite length and two free surfaces in a vertical straight tube under the action of magnetic fields was studied in this paper; numerical solution was obtained by the time dependent method in a finite difference technique. The results show that under the action of a proper magnetic field, the axial velocity at the lower meniscus near the axis will decrease, strike on the lower meniscus will be reduced, and then thrombus formation at the lower meniscus can be avoided. This result provides a guide to further experimental research on the mechanism of thrombus formation and medical treatment to thrombus. EI

**N94-36522** Naval Research Lab., Bay Saint Louis, MS.

### **INDICATORS FOR SULFATE-REDUCING BACTERIA IN MICROBIOLOGICALLY INFLUENCED CORROSION Final Report**

BRENDA LITTLE and PATRICIA WAGNER Apr. 1994 21 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality (Contract NR PROJ. 03103)

(AD-A278914; NRLD-BC-005-92-333) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Microbiologically influenced corrosion (MIC) is localized corrosion and results in pitting, crevice corrosion, selective dealloying, stress corrosion cracking, or under-deposit corrosion. Since MIC does not produce unique forms of corrosion, investigators have relied on the shape, color, smell, and morphology of surface deposits in association with numbers and types of organisms to indicate MIC. DTIC

**N94-36554#** Argonne National Lab., IL.

### **SOLVENT EFFECTS ON THE ENERGETICS AND DYNAMICS OF ULTRAFAST ELECTRON TRANSFER IN CHLOROPHYLL-PORPHYRIN-ACCEPTOR TRIADS**

G. P. WIEDERRECHT, S. WATANABE, and M. R. WASIELEWSKI 1994 4 p Presented at the 9th International Conference on Ultrafast Phenomena, Dana Point, CA, 1-5 May 1994 (Contract W-31-109-ENG-38)

(DE94-009693; ANL/CHM/CP-81878; CONF-940593-9) Avail:



## 51 LIFE SCIENCES (GENERAL)

### CASI HC A01/MF A01

An understanding of the role of the medium that lies between electron donors and acceptors is particularly important for the study of photosynthetic reaction centers where the medium is thought to have a large influence on the observed rates of electron transfer. In the bacterial photosynthetic reaction center a bacteriochlorophyll (BChl) molecule lies between the dimeric bacteriochlorophyll (BChl2) and the bacteriopheophytin (BPh) acceptor. Femtosecond transient absorption spectroscopy of native reaction centers has yielded evidence for both superexchange and two-step electron transfer mechanisms mediated by the bridging BChl. We have prepared molecules that mimic this structural arrangement to better understand the influence of solvation dynamics and the low-lying electron states of a bridging porphyrin molecule (ZP) on electron transfer rates within molecules that possess a chlorophyll donor (ZC) and either a naphthoquinone (NQ) or a 3,4,9,10-perylene-tetracarboxydiimide (PER) acceptor. DOE

**N94-36555#** Argonne National Lab., IL.  
**FEMTOSECOND TRANSIENT GRATING STUDIES OF ELECTRON TRANSFER IN PORPHYRIN AND CHLOROPHYLL DONOR-ACCEPTOR MOLECULES**  
G. P. WIEDERRECHT, W. A. SVEC, and M. R. WASIELEWSKI  
1994 4 p Presented at the 9th International Conference on Ultrafast Phenomena, Dana Point, CA, 1-5 May 1994 (Contract W-31-109-ENG-38) (DE94-009694; ANL/CHM/CP-81875; CONF-940593-8) Avail: CASI HC A01/MF A01

Transient grating studies of electron transfer in artificial photosynthetic systems are described. These systems include simple donor-acceptor molecules where the donor, a chlorophyll or porphyrin, is rigidly attached to an easily reduced species such as naphthoquinone or benzoquinone. We have previously synthesized acceptor molecules which have well defined absorption bands upon reduction and are well removed from the excited and cationic states of porphyrins and chlorophylls. They also possess large molar extinction coefficients that dominate the spectra and have well defined polarization characteristics. These traits are ideal for polarization sensitive transient grating experiments which enable accurate determination of the angle of the transition dipole between the initial excitation and the acceptor probe, dynamic solvation effects on the charge separated species, and any time dependent rotation of the chromophores relative to each other. An example of the type of molecule utilized for these experiments is a free base porphyrin (HP) donor and a pyromellitic diimide (PI) acceptor directly bonded to the porphyrin ring. DOE

**N94-36720#** Bio En-Gene-Er Associates, Inc., Wilmington, DE.  
**OPPORTUNITIES FOR INNOVATION: BIOTECHNOLOGY**  
R. M. BUSCHE Sep. 1993 275 p (Contract NANB2D1219) (PB94-157831; NIST/GCR-93/633) Avail: CASI HC A12/MF A03

The purpose of this project is to help small businesses get on the fast track in biotechnology research and development leading to the spin off of viable commercial businesses, probably with the help of larger companies having the resources for commercialization that are lacking in a small enterprise. Such resources could include financing, and positions in marketing, manufacturing, regulatory affairs, and raw material supply, to name a few. In general, biotechnology can be expected to have a major impact on fundamental human needs engendered in the market segments of: health care, agriculture, forestry, food ingredients, industrial chemicals, plastics, energy, mining, pollution control, and bioelectronics. NTIS

**N94-36751\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.  
**RECOMBINANT PROTEIN PRODUCTION AND INSECT CELL CULTURE AND PROCESS Patent Application**  
GLENN SPAULDING, inventor (to NASA), TACEY PREWETT, inventor (to NASA), THOMAS GOODWIN, inventor (to NASA), KAREN FRANCIS, inventor (to NASA), ANGELA ANDREWS,

inventor (to NASA), and KIM OCONNOR, inventor (to NASA) 14 May 1993 26 p (NASA-CASE-MS-C-22336-1; NAS 1.71:MSC-22336-1; US-PATENT-APPL-SN-062856) Avail: CASI HC A03/MF A01

A process has been developed for recombinant production of selected polypeptides using transformed insect cells cultured in a horizontally rotating culture vessel modulated to create low shear conditions. A metabolically transformed insect cell line is produced using the culture procedure regardless of genetic transformation. The recombinant polypeptide can be produced by an alternative process using the cultured insect cells as host for a virus encoding the described polypeptide such as baculovirus. The insect cells can also be a host for viral production. NASA

**N94-36765\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.  
**THREE DIMENSIONAL OPTIC TISSUE CULTURE AND PROCESS Patent Application**  
GLENN F. SPAULDING, inventor (to NASA), TACEY L. PREWETT, inventor (to NASA), THOMAS J. GOODWIN, inventor (to NASA), KAREN M. FRANCIS, inventor (to NASA), DELMAR R. CARDWELL, inventor (to NASA), KIM OCONNOR, inventor (to NASA), WENDY S. FITZGERALD, inventor (to NASA), and LAURIE A. ATEN, inventor (to NASA) 13 Mar. 1994 23 p (NASA-CASE-MS-C-22368-1; NAS 1.71:MSC-22368-1; US-PATENT-APPL-SN-242546) Avail: CASI HC A03/MF A01

A process for artificially producing three-dimensional optic tissue has been developed. The optic cells are cultured in a bioreactor at low shear conditions. The tissue forms normal, functional tissue organization and extracellular matrix. NASA

**N94-36986\*#** San Jose State Univ., CA. Dept. of Biological Sciences.  
**GROUND AND SPACE FLIGHT EXPERIMENTS OF THE EFFECTS OF LIGHT, SOUND AND/OR TEMPERATURE ON ANIMALS Final Report**  
DANIEL C. HOLLEY, VINCE DU, JILL ERIKSON, JACK GOTT, HEATHER HINCHCLIFFE, GARY MELE, KAREN MOELLER, TAM NGUYEN, SARAH OKUMURA, MARK ROBBINS et al. 3 Jun. 1994 293 p (Contract NCC2-593) (NASA-CR-196102; NAS 1.26:196102) Avail: CASI HC A13/MF A03

Papers on the following topics are presented: (1) rat long term habitability and breeding under low light intensity (5 lux); (2) effects of low light intensity on the rat circadian system; (3) effects of sound/noise on the circadian system of rats; (4) temperature related problems involving the animal enclosure modules (AEM) lighting system; and (5) NASA AEM filter test 92/93 (Rats). CASI

**N94-36996\*#** Florida Inst. of Tech., Melbourne, FL. Dept. of Biological Sciences.  
**RAPID SUSCEPTIBILITY TESTING OF MYCOBACTERIUM AVIUM COMPLEX AND MYCOBACTERIUM TUBERCULOSIS ISOLATED FROM AIDS PATIENTS Final Progress Report, 1 Jun. 1992 - 31 May 1994**  
ARVIND M. DHOPLE 1994 6 p (Contract NAG10-0106) (NASA-CR-196268; NAS 1.26:196268) Avail: CASI HC A02/MF A01

In ominous projections issued by both U.S. Public Health Service and the World Health Organization, the epidemic of HIV infection will continue to rise more rapidly worldwide than predicted earlier. The AIDS patients are susceptible to diseases called opportunistic infections of which tuberculosis and Mycobacterium avium complex (MAC) infection are most common. This has created an urgent need to uncover new drugs for the treatment of these infections. In the seventies, NASA scientists at Goddard Space Flight Center, Greenbelt, MD, had adopted a biochemical indicator, adenosine triphosphate (ATP), to detect presence of life in extraterrestrial space. We proposed to develop ATP assay technique to

determine sensitivity of antibacterial compounds against MAC and M. tuberculosis. Derived from text

**N94-37045** Naval Aerospace Medical Research Lab., Pensacola, FL.

**BEHAVIORAL PERFORMANCE IN MONKEYS EXPOSED TO TEMPO HIGH-PEAK-POWER MICROWAVE PULSES AT 3 GHZ**  
Interim Report, 1992-1993

J. A. DANDREA, B. L. COBB, J. KNEPTON, and F. BATES  
Dec. 1993 22 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality  
(Contract PROJ. MM3-3130)  
(AD-A280551; NAMRL-1389) Avail: CASI HC A03/MF A01

The development of adequate safety standards for exposure to microwave radiation requires an extensive database which provides information on frequency, power, and modulation characteristics. This study was conducted to provide information on the behavioral effects of high-peak-power microwave pulses produced by an axially extracted virtual cathode oscillator. This pulsed microwave source, TEMPO (transformer energized megavolt pulsed output), was located at the Walter Reed Army Institute of Research and for this study was configured to produce high-peak-power 3.0 GHz microwave pulses, 20-60 ns pulse duration with a 7.5 s interpulse interval. To investigate the behavioral effects of the high peak power pulses, four male rhesus monkeys (*Macaca mulatta*) were trained on a operant color discrimination task for food pellet reward. The task was twofold requiring monkeys to pull one plastic lever on a variable interval schedule (VI-25 s) and then respond to color signals and pull a second lever to obtain food. During the behavioral task, the monkeys were exposed to microwave pulses produced by TEMPO. Peak field power densities averaged 45.63 kW/sq cm, which produced a peak whole body specific absorption rate (SAR) of approximately 2.21 MW/kg (specific absorption (SA) per pulse was 1.3 J/kg). Average whole-body SAR, however, was low due to the short pulse duration and long interpulse interval. Behavioral performance on either component of the task was not altered significantly by the high-peak-power pulses. DTIC

**N94-37156#** California Univ., Berkeley. Lawrence Berkeley Lab, CA. Dept. of Biophysics.

**HIGH RESOLUTION ELECTRON DIFFRACTION ANALYSIS OF STRUCTURAL CHANGES ASSOCIATED WITH THE PHOTOCYCLE OF BACTERIORHODOPSIN** Ph.D. Thesis

BONG-GYOON HAN Apr. 1994 199 p  
(Contract DE-AC03-76SF-00098)  
(DE94-011800; LBL-35448) Avail: CASI HC A09/MF A03

Changes in protein structure that occur during the formation of the M photointermediate of bacteriorhodopsin can be directly visualized by electron diffraction techniques. Samples containing a high percentage of the M intermediate were trapped by rapidly cooling the crystals with liquid nitrogen following illumination with filtered green light at 240K and 260K respectively. Difference Fourier projection maps for M minus bR at two temperatures and for M(sub 260K) minus M(sub 240K) are presented. While it is likely that a unique M-substate is trapped when illuminated at 260K, the data indicate that the sample illuminated at 260 K produces a mixture of the M(sub 240K) substate and a second M-substate which may have a protein structure similar to the N-intermediate. The diffraction data clearly show that statistically significant structural changes occur upon formation of the M(sub 240K) specimen and then further upon formation of the second substate which is present in the mixture that is produced at 260K. A preliminary 3-D difference map, based on data collected with samples tilted up to 30 degrees, has been constructed at a resolution of 3.5 Angstrom parallel to the membrane plane and a resolution of 8.5 Angstrom perpendicular to the membrane. The data have been analyzed by a number of different criteria to ensure that the differences seen reflect real conformational changes at a level which is significantly above the noise in the map. Furthermore, a comparison of the positions of specific backbone and side-chain groups relative to significant difference peaks suggests that it will be necessary to further refine the atomic resolution model before

it will be possible to interpret the changes in chemical structure that occur in the protein at this stage of the photocycle. DOE

**N94-37248#** Cornell Univ., Ithaca, NY. Dept. of Soil, Crop and Atmospheric Sciences.

**EFFECTS OF FREEZING AND COLD ACCLIMATION ON THE PLASMA MEMBRANE OF ISOLATED PROTOPLASTS**

P. L. STEPONKUS 1994 6 p  
(Contract DE-FG02-84ER-13214)  
(DE94-012487; DOE/ER-13214/8) Avail: CASI HC A02/MF A01

Our aim is to provide a mechanistic understanding of the cellular and molecular aspects of freezing injury and cold acclimation from a perspective of the structural and functional integrity of the plasma membrane - the primary site of freezing injury in winter cereals. We established that destabilization of the plasma membrane of winter rye, the most freezing-tolerant winter cereal, can result from several different lesions: expansion induced lysis, lamellar-to-hexagonal 2 phase transitions, and the fracture-jump lesion. The occurrence and incidence of these various lesions, depends on the freeze/thaw protocol and the stage of cold acclimation. In non-acclimated leaves and protoplasts, expansion-induced lysis is the predominant lesion at temperatures between -2 and -5 C, whereas freeze-induced formation of the H(sub II) phase is the predominant lesion at temperatures below -10 C. We investigated whether the difference in freezing tolerance and the threshold temperatures at which the lesions occur in rye and oats are a consequence of differences in the lipid composition of the plasma membrane. There are substantial differences between rye and oat cell membranes both before and after cold acclimation. The plasma membrane of oat contains greater proportions of acylated sterylglucosides and cerebrosides than that of rye, and there is little change in these two lipid classes during cold acclimation. The haptotropic phase behavior of lipid mixtures that resemble the plasma membrane of rye and oat was studied. The differences in lipid composition of rye and oats are of mechanistic significance because of their influence on the hydration characteristics of the plasma membrane, the propensity for dehydration-induced lipid-lipid demixing, and the intrinsic curvature of the lipid monolayers. These studies suggest that strategies for improving the freezing tolerance of winter cereals should include approaches to modify membrane lipid composition. DOE

**N94-37355#** Lawrence Livermore National Lab., Livermore, CA. THE PROBLEMS OF THE MINIMAL SURFACE AND MINIMAL LINEAL MEASURE IN THREE DIMENSIONS

R. M. CHRISTENSEN Feb. 1994 19 p  
(Contract W-7405-ENG-48)  
(DE94-013002; UCRL-CR-116392) Avail: CASI HC A03/MF A01

A solution is given to the classical problem of the minimal surface in three dimensions formed from a repeating cell microstructure under isotropic conditions. The solution is found through a global/local minimization procedure and the resulting basic cell is composed of 14 faces. At the junctions where the intersections between faces meet at a point, half of the junctions involve 4 intersections and half involve 3 intersections. The same general solution also applies to the related minimal lineal measure problem where the measure is that of the length of the intersections connecting the junctions. Some implications and applications for materials science are given. DOE

**N94-37434#** Cornell Univ., Ithaca, NY.

**CONVERSION OF ACETIC ACID TO METHANE BY THERMOPHILES**

STEPHEN H. ZINDER Feb. 1994 8 p  
(Contract DE-FG02-85ER-13370)  
(DE94-012478; DOE/ER-13370/T3) Avail: CASI HC A02/MF A01

Acetate is the precursor of approximately two-thirds of the methane produced by anaerobic bioreactors and many other methanogenic habitats. Besides their intrinsic interest, thermophilic acetotrophic methanogenic cultures usually grow at least twice as fast as their mesophilic counterparts, making them more amenable to study. In recent years, attention has been mainly focused on the

thermophilic acetate-utilizing methanogen Methanotrix strain CALS-1. Methanotrix, also called Methanosaeta, is one of only two methanogenic genera known to convert acetate to methane, the other being Methanosarcina. The faster-growing more versatile Methanosarcina has been better studied. However, when one examines anaerobic digester contents, Methanotrix is often the dominant acetate-utilizing methanogen. As described in previous progress reports, the authors have achieved methanogenesis from acetate in cell-free extracts of Methanotrix strain CALS-1 grown in a pH auxostat. Using these cell extracts, specific activities for methanogenesis from acetate and ATP of 100-300 nmol/min were routinely obtained, levels comparable to the rate in whole cells, which is not usually the case in methanogenic extracts. Recently obtained results are given and discussed for the following: methanogenesis in crude extracts; role of the cell membrane in methanogenesis from acetate; carbon monoxide dehydrogenase; novel thermophilic cultures converting acetate to methane; and methanol-utilizing methanogen. DOE

**N94-37535#** China Nuclear Information Centre, Beijing (China). **STUDYING OF ION IMPLANTATION EFFECT ON THE BIOLOGY IN CHINA**

ENG-LIANG YU (Academia Sinica, Hefei, China.) Apr. 1993 12 p  
(DE94-620692; CNIC-00746; ASIPP-0036) Avail: CASI HC A03/MF A01 (US Sales Only)

Since low energy ion effect on the biology was observed, the ion implantation as a new mutagenic source has been widely used in improving crops and modifying microbes in China. The basic phenomenon of ion implantation effect on the biology and analytical results are reported, and the examples of its application and its further development are shown. DOE

**N94-37625#** Pacific Northwest Lab., Richland, WA. **INVESTIGATION OF EXPOSURE TO EXTREMELY LOW FREQUENCY (ELF) MAGNETIC AND ELECTRIC FIELDS: ONGOING ANIMALS STUDIES**

L. E. ANDERSON Mar. 1994 10 p Presented at the Electric Power Research Institute EMF Seminar on Focus on Research, Santa Clara, CA, 14-16 Mar. 1994  
(Contract DE-AC06-76RL-01830)  
(DE94-011239; PNL-SA-23995; CONF-9403111-1) Avail: CASI HC A02/MF A01

There is now convincing evidence from a large number of laboratories, that exposure to extremely low frequency (ELF) magnetic and electric fields produces biological responses in animals. Many of the observed effects appear to be directly or indirectly associated with the neural or neuroendocrine systems. Such effects include increased neuronal excitability, chemical and hormonal changes in the nervous system, altered behavioral responses (some of which are related to sensing the presence of the field) and changes in endogenous biological rhythms. Additional indices of general physiological status appear relatively unaffected by exposure, although effects have occasionally been described in bone growth and fracture repair, reproduction and development, and immune system function. A major current emphasis in laboratory research is to determine whether or not the reported epidemiological studies that suggest an association between EMF exposure and risk of cancer are supported in studies using animal models. Three major challenges exist for ongoing research: (1) knowledge about the mechanisms underlying observed bioeffects is incomplete; (2) researchers do not as yet understand what physical aspects of exposure produce biological responses; and (3) health consequences resulting from ELF exposure are unknown. Although no animal studies clearly demonstrate deleterious effects of ELF fields, several are suggestive of potential health impacts. From the perspective of laboratory animal studies, this paper discusses biological responses to ELF magnetic and/or electric field exposures. DOE

## AEROSPACE MEDICINE

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

**A94-61987**

**HOW MUCH DOES ILLUMINANT COLOR AFFECT UNATTRIBUTED COLORS?**

LAWRENCE E. AREND Harvard Medical School, Boston, MA *Journal of the Optical Society of America A: Optics and Image Science* (ISSN 0740-3232) vol. 10, no. 10 October 1993 p. 2134-2147 refs  
(BTN-94-EIX94331324107) Copyright

The author presents a question as to whether the light coming from a surface (as opposed to the surface color) appear the same after adaptation to a new illumination as it did before the illumination changed. A mental standard was used, by his observers, to provide a comparison stimulus that is unaffected by the adaptation being tested. How to determine the theoretical chromaticity shifts that represent illumination invariance for comparison with the data is the main evaluation problem. Rather than actual surfaces and illuminants, the author used light sources. He determined theoretical surfaces that would have unique hues under the test illuminants by using a new technique. EI

**N94-36764#** East Carolina Univ., Greenville, NC. School of Medicine.

**EVALUATION OF DRIED STORAGE OF PLATELETS FOR TRANSFUSION: PHYSIOLOGIC INTEGRITY AND HEMOSTATIC FUNCTIONALITY Triannual Report No. 1, 1 Feb. - 31 May 1994**

ARTHUR P. BODE 17 Jun. 1994 7 p  
(Contract N00014-92-J-1244)  
(AD-A280665) Avail: CASI HC A02/MF A01

Technical and administrative activities performed under this grant are briefly summarized. A subcontract summary is included addressing the hemostatic and thrombogenic effects of the rehydrated platelets and the characterization of the surface antigens of rehydrated platelets. Derived from text

**N94-36766\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**METHOD AND APPARATUS FOR THE COLLECTION, STORAGE, AND REAL TIME ANALYSIS OF BLOOD AND OTHER BODILY FLUIDS Patent Application**  
PEGGY A. WHITSON, inventor (to NASA) and VAUGHAN L. CLIFT, inventor (to NASA) 19 May 1994 30 p  
(NASA-CASE-MS-C-22463-1; NAS 1.71:MSC-22463-1; US-PATENT-APPL-SN-247189) Avail: CASI HC A03/MF A01

The present invention provides a simple, portable, relatively inexpensive apparatus for accurately and efficiently collecting, separating, testing, and even storing between about 1-20 ml, preferably about 1-10 ml, of blood or other bodily fluid in situ. The apparatus includes a collection chamber bounded on its sides by an opening in a sheet of material, preferably clear plastic, abutting a filter card. The filter card is made of fibrous material, preferably less than about a millimeter thick, having an average pore size of less than about 3 microns. Preferably, the fibers are glass and the fibrous material has an average pore size of about 1 micron. The fibrous material is treated with a carbohydrate/protein mixture which contains between about 1-40 percent wt/vol carbohydrate and about 0.1-15 percent wt/vol nonspecific protein, preferably between about 10-20 percent carbohydrate and about 5-8 percent protein. A preferred carbohydrate/protein mixture comprises about 10 percent mannitol and about 6 percent albumin. The blood or other fluid moves through the filter card by capillary action aided by an absorbent matrix with a high Klömm factor which abuts the filter card. The absorbent matrix and/or filter card can be treated with a wide spectrum of test reagents. The speed, cleanliness, and efficiency of

the separation process can be altered by: (a) changing the absolute concentration of the carbohydrate/protein mixture; (b) applying positive or negative pressure to one side of the filter; and/or (c) varying the relative density and pore size of the filter card and absorbent matrix. NASA

**N94-37005\*** Good Samaritan Hospital and Medical Center, Portland, OR. Neurological Sciences Inst. and Clinical Vestibular Lab.

**RELATION OF MOTION SICKNESS SUSCEPTIBILITY TO VESTIBULAR AND BEHAVIORAL MEASURES OF ORIENTATION Annual Status Report**

ROBERT J. PETERKA Jul. 1994 29 p  
(Contract NAGW-3782)

(NASA-CR-196121; NAS 1.26:196121) Avail: CASI HC A03/MF A01

The objective of this proposal is to determine the relationship of motion sickness susceptibility to vestibulo-ocular reflexes (VOR), motion perception, and behavioral utilization of sensory orientation cues for the control of postural equilibrium. The work is focused on reflexes and motion perception associated with pitch and roll movements that stimulate the vertical semicircular canals and otolith organs of the inner ear. This work is relevant to the space motion sickness problem since 0 g related sensory conflicts between vertical canal and otolith motion cues are a likely cause of space motion sickness. Results of experimentation are summarized and modifications to a two-axis rotation device are described. Abstracts of a number of papers generated during the reporting period are appended. Derived from text

**N94-37089** National Inst. of Standards and Technology, Gaithersburg, MD.

**CHEMICAL AND STRUCTURAL CHARACTERIZATION OF NITROAROMATIC ADDUCTS WITH HEMOGLOBINS Final Report, 15 Jul. 1992 - 30 Sep. 1993**

WALTER J. STEVENS 1 Feb. 1994 59 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract MIPR-92MM2588)

(AD-A280533; USAMRDALC-01) Avail: CASI HC A04

The reactivity of dinitrobenzene (ortho-, para-, meta-DNB) with bovine he has been studied in vitro using spectroscopic and chromatographic methods. Deconvolution of time-dependent VIS/UV spectra of mixtures of hemoglobin with DNB show that DNB reacts readily with deoxyhemoglobin to form methemoglobin without the need for metabolic activation that has been inferred from previous in vivo studies. No reaction is observed with oxy- or carboxy-hemoglobin. Column and HPLC chromatographic separations of hemoglobin treated with C-14 radiolabelled DNB did not produce evidence for adduct formation. Similar analyses of hemoglobin from radiolabelled DNB- and TNB-treated rats also showed no direct evidence of strong adducts. DTIC

**N94-37118** Edgerton, Germeshausen and Grier, Inc., Albuquerque, NM.

**BLAST OVERPRESSURE STUDIES WITH ANIMALS AND MAN Final Report**

DANIEL L. JOHNSON 31 Oct. 1993 265 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract DAMD17-88-C-8141; DA PROJ. 3M1-62787-A-878)

(AD-A280240) Avail: CASI HC A12

The U.S. Army needs realistic safe limits for exposure to impulse noise produced by heavy weapons. Impulse noise limits, based on data from small arms, may be overly conservative. In order to define new limits for heavy weapons, this systematic 5-year study of the effects of high-intensity impulse noise on human volunteers was undertaken. The number of impulses, the peak pressure levels, and spectral distributions of energy of heavy weapon-like impulses were varied systematically. Five major groups of 273 volunteers were given a series of exposures to one of three impulse types and to three types of hearing protection. The impulse spectrum was

varied by changing the distance between the volunteer and an explosive detonation. The peak pressure level was varied in 3-dB steps by changing the weight of the explosive charge. The number of impulses per day was 6, 12, 25, 50, or 100. Volunteers wore hearing protection for all exposures. After each exposure, the amount of TTS, if any, was determined. Each volunteer started with an exposure of six impulses at the lowest intensity. If the TTS was less than 15 dB, the subject received six impulses at the next higher level the next day. DTIC

**N94-37124** Krug Life Sciences, Inc., San Antonio, TX. **HYPOBARIC DECOMPRESSION SICKNESS MODEL DEVELOPMENT. PART 1: DIFFUSION OF INERT GAS FROM A VISCOELASTIC FLUID (BLOOD) INTO AN EXPANDING GAS PHASE Interim Report, 16 Mar. 1993 - 31 Jan. 1994**

LAMBROS J. PETROPOULOS Apr. 1994 15 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract F33615-92-C-0018)

(AD-A280298; AL/CF-TR-1994-0029-PT-1) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Bubble growth within a volume of isothermal viscoelastic liquid containing uniformly distributed dissolved gas is considered. A nonlinear viscoelastic constitutive equation is used as a blood model. The problem of characterizing this growth-by-mass-transfer is being treated extensively, in order to better understand both the behavior of bubble growth due to supersaturation and its effects on altitude decompression sickness. DTIC

**N94-37136** Army Research Inst. of Environmental Medicine, Natick, MA.

**HOMEOSTATIC RESPONSES TO PROLONGED COLD EXPOSURE: HUMAN COLD ACCLIMATIZATION**

ANDREW J. YOUNG May 1994 79 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(AD-A280234; USARIEM-TR-T94-11) Avail: CASI HC A05

This report reviews human physiological adjustments induced by chronic exposure to cold stress. Three broad types of adjustments are identified. The most commonly observed adjustment exhibited by humans chronically exposed to cold is a hypothermic habituation. Blunted shivering and vasoconstrictor responses to cold characterize this adjustment which enables maintenance of warmer skin during cold exposure. Metabolic acclimatization/acclimation has been observed in which shivering response to cold becomes exaggerated. Insulative acclimatization/acclimation has also been observed in which persons chronically exposed to cold vasoconstrict cutaneous vasculature more readily. The factors determining which pattern of adjustment occurs remain unidentified, although a theoretical explanation is presented which is based on the intensity of the cold stress experienced. DTIC

**N94-37140#** Texas A&M Univ., College Station, TX. Dept. of Biology.

**MELATONIN, THE PINEAL GLAND, AND CIRCADIAN RHYTHMS Annual Report, 1 Mar. 1993 - 28 Feb. 1994**

VINCENT M. CASSONE 28 Feb. 1994 6 p

(Contract AF-AFOSR-0244-90)

(AD-A280467; AFOSR-94-0358TR) Avail: CASI HC A02/MF A01

Pineal melatonin may effect the light sensitivity of rats such that, pineal ectomized rats perceive ambient intensity to be higher than sham-operated controls. We have tested this several ways. Essentially, we can find no evidence that pinealectomized rats are more sensitive to light than are pinealectomized rats. We have found that free-running circadian period lengthens in response to increasing light intensities at the same rate, but that pinealectomized rats become disrupted at lower intensities than do sham-operated animals. Further, our initial observation that enucleation of rats abolishes SCN iodomelatonin binding has proven incorrect when we corrected for circadian phase. Pineal melatonin influences circadian system coupling either at the level of coupling among circadian

oscillators themselves or between these oscillators and their multiple outputs. DTIC

**N94-37197#** Lawrence Livermore National Lab., Livermore, CA. **DETECTION OF THE ELECTROCARDIOGRAM P-WAVE USING WAVELET ANALYSIS**

KANWALDIP S. ANANT, GARRY H. RODRIGUE, and FARID U. DOWLA Jan. 1994 8 p Presented at the Society of Photo-Optical Instrumentation Engineers Conference on Intelligent Information Systems, Orlando, FL, 4-8 Apr. 1994 (Contract W-7405-ENG-48) (DE94-010791; UCRL-JC-115855; CONF-940449-7) Avail: CASI HC A02/MF A01

Since wavelet analysis is an effective tool for analyzing transient signals, we studied its feature extraction and representation properties for events in electrocardiogram (EKG) data. Significant features of the EKG include the P-wave, the QRS complex, and the T-wave. For this paper the feature that we chose to focus on was the P-wave. Wavelet analysis was used as a pre-processor for a backpropagation neural network with conjugate gradient learning. The inputs to the neural network were the wavelet transforms of EKG's at a particular scale. The desired output was the location of the P-wave. The results were compared to results obtained without using the wavelet transform as a pre-processor. DOE

**N94-37224** Texas Univ., Houston, TX. Dept. of Anesthesiology. **CARDIAC PRESSURE CHANGES WITH VENOUS GAS EMBOLISM AND DECOMPRESSION** Final Report, Nov. 1991 - Sep. 1993

BRUCE D. BUTLER and GEORGE B. KEMPER Apr. 1994 30 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality (Contract F33615-90-D-0606; F33615-90-D-0014) (AD-A280412; AL/AO-TR-1993-0176) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Venous air embolism is reported with decompression to a decreased ambient pressure. With severe decompressions or in cases where an intracardiac septal defect (patent foramen ovale) exists, the venous bubbles can become arterialized and cause neurological decompression illness. Incidence rates of patent foramen ovale in the general population range from 25-34% and yet aviators, astronauts, and undersea divers who have decompression-induced venous bubbles do not demonstrate neurological symptoms at these high rates. This apparent disparity may be attributable to the normal pressure gradient across the atria of the heart that must be reversed for there to be flow patency. We evaluated the effects of (1) venous air embolism (0.025, 0.05 and 0.15 ml\*kg<sup>-1</sup>\*min<sup>-1</sup> for 180 min, (2) hyperbaric decompression, and (3) hypobaric decompression on the pressure gradient across the left and right atria. Left ventricular end-diastolic pressure was used as a measure of left atrial pressure. In a total of 92 experimental evaluations, there were no reported reversals in the mean pressure gradient across the atria, and a total of 3 transient reversals in the peak gradient pressures. This disparity may be due to insufficient amounts of venous gas to cause a pressure and hence flow reversal across the atria. DTIC

**N94-37263\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX. **PROFILE ANALYSIS OF AFTER-EFFECTS EXPERIENCED DURING EXPOSURE TO SEVERAL VIRTUAL REALITY ENVIRONMENTS**

ROBERT S. KENNEDY (Essex Corp., Orlando, FL.), MARSHALL B. JONES (Hershey, Milton S. Medical Center, Hershey, PA.), MICHAEL G. LILIENTHAL (Defense Logistics Agency, Alexandria, VA.), and DEBORAH L. HARM In AGARD, Virtual Interfaces: Research and Applications 9 p May 1994 Copyright Avail: CASI HC A02/MF A02

Motion sickness symptoms are an unwanted by-product of exposure to virtual environments. This problem is not new and was reported in the early flight simulators and experiments on ego

motions and vection. The cardinal symptom of motion sickness is, of course, vomiting, but this symptom is ordinarily preceded by a variety of other symptoms. In his classic studies of motion sickness conducted before and during World War II, G. R. Wendt introduced a three point scale to score motion sickness beyond a vomit/no vomit dichotomy. Later, Navy scientists developed a Motion Sickness Questionnaire (MSQ), originally for use in a slowly rotating room. In the last 20 years the MSQ has been used in a series of studies of air, sea, and space sickness. Only recently, however, has it been appreciated that symptom patterns in the MSQ are not uniform but vary with the way sickness is induced. In seasickness, for example, nausea is the most prominent symptom. In Navy simulators, however, the most common symptom is eye strain, especially when cathode ray tubes are employed in the simulation. The latter result was obtained in a survey of over 1,500 pilot exposures. Using this database, Essex scientists conducted a factor analysis of the MSQ. We found that signs and symptoms of motion sickness fell mainly into three clusters: 1) oculomotor disturbance, 2) nausea and related neurovegetative problems, and 3) disorientation, ataxia, and vertigo. We have since rescored the MSQ results obtained in Navy simulators in terms of these three components. We have also compared these and other profiles obtained from three different virtual reality systems to profiles obtained in sea sickness, space sickness, and alcohol intoxication. We will show examples of these various profiles and point out similarities and differences among them which indicate aspects of what might be called 'virtual-reality sickness'. Author

**N94-37276#** Naval Aerospace Medical Research Lab., Pensacola, FL. Acceleration Div.

**ATTENUATING THE DISORIENTING EFFECTS OF HEAD MOVEMENT DURING WHOLE-BODY ROTATION USING A VISUAL REFERENCE: FURTHER TESTS OF A PREDICTIVE HYPOTHESIS**

B. D. LAWSON, F. E. GUEDRY, A. R. RUPERT, and A. M. ANDERSON In AGARD, Virtual Interfaces: Research and Applications 14 p May 1994 (Contract N00014-90-J-1549) Copyright Avail: CASI HC A03/MF A02

Research has shown that when subjects are seated upright and asked to perform an earthward head movement in the dark during whole-body rotation, they find the head movement disorienting if it is preceded by prolonged rotation of constant velocity, but not if it is made during the initial acceleratory phase of rotation. The disorienting effects of a head movement after prolonged constant velocity rotation can be attenuated by providing a visual reference to the Earth before the head movement. However, humans may not respond to vestibular or optokinetic simulation the same way for different planes of motion. We tested the disorienting effects of an earthward head movement during rotation about a vertical axis to see if the attenuating effect of a visual reference would be altered. Some subjects were tested while lying on their side and some while lying on their back. Subjective reports concerning head movements in the dark were similar to previous research, suggesting that an acceleratory stimulus in the plane of rotation will attenuate disorientation, regardless of the plane of rotation tested. Likewise, the visual reference attenuated the disorientation that is usually associated with a head movement following prolonged constant velocity rotation. However, the visual reference did not appear to exert as strong an attenuating effect as it had for subjects seated upright. The implication of this finding for the design of centrifuge-based flight simulators is discussed. Author

**N94-37277#** Army Personnel Research Establishment, Farnborough (England). Special Psychology Research Group. **SOME SIDE-EFFECTS OF IMMERSION VIRTUAL REALITY**

E. C. REGAN In AGARD, Virtual Interfaces: Research and Applications 8 p May 1994 Copyright Avail: CASI HC A02/MF A02

Virtual reality (VR) has become increasingly well-known over the last few years. However, little is known about the side-effects of

prolonged immersion in VR. The main study described in this paper set out to investigate the frequency of occurrence and severity of side-effects of using an immersion VR system. Out of 150 subjects 61 percent reported symptoms of malaise at some point during a 20 minute immersion and 10 minute post-immersion period. These ranged from symptoms such as dizziness, stomach awareness, headaches, eyestrain, and lightheadedness to severe nausea. Some research which has been conducted which attempted to identify those factors that play a causative role in the side-effects of the VR system is discussed. Finally, some areas for future research are highlighted. Author

**N94-37282\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA. ESTIMATES OF CELLULAR MUTAGENESIS FROM COSMIC RAYS**

FRANCIS A. CUCINOTTA and JOHN W. WILSON Jul. 1994 13 p  
(Contract RTOP 199-45-16-11)  
(NASA-TP-3453; L-17377; NAS 1.60:3453) Avail: CASI HC A03/MF A01

A parametric track structure model is used to estimate the cross section as a function of particle velocity and charge for mutations at the hypoxanthine guanine phosphoribosyl transferase (HGPRT) locus in human fibroblast cell cultures. Experiments that report the fraction of mutations per surviving cell for human lung and skin fibroblast cells indicate small differences in the mutation cross section for these two cell lines when differences in inactivation rates between these cell lines are considered. Using models of cosmic ray transport, the mutation rate at the HGPRT locus is estimated for cell cultures in space flight and rates of about  $2$  to  $10 \times 10^{-6}$  per year are found for typical spacecraft shielding. A discussion of how model assumptions may alter the predictions is also presented. Author (revised)

**N94-37353 IIT Research Inst., Chicago, IL. ELF COMMUNICATIONS SYSTEM ECOLOGICAL MONITORING PROGRAM: ELECTROMAGNETIC FIELD MEASUREMENTS AND ENGINEERING SUPPORT Final Report**

D. P. HARADAM, J. R. GAUGER, and J. E. ZAPOTOSKY Apr. 1994 375 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality  
(Contract N00039-93-C-0001)  
(AD-A280489) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The ELF Communications System enables the U.S. Navy to communicate with submarines worldwide at operational depth and speed. The system consists of transmitting facilities in Wisconsin and Michigan that synchronously broadcast messages. Transmitters became fully operational in Wisconsin in 1985 and in Michigan in 1989. In situ studies to monitor for possible bioelectromagnetic effects from operation of both transmitters were initiated in 1982. The studies use a split-plot or blocked strategy to examine differences in space (treatment/control sites) or time (preoperational/operational). Physiological, developmental, behavioral, and ecological variables for dominant biota in upland, wetland, and riverine habitats near the ELF system have been examined in these studies. In Wisconsin, data collection for all studies was completed by the end of 1989; in Michigan, data collection continued through 1993. In support of this research, IIT Research Institute has annually documented the ambient ELF electromagnetic (EM) environment, including EM fields produced by both the ELF system and electric power distribution (60 Hz). This report documents ELF EM field intensities at all study sites active in 1993, and is comprehensive for the period 1983-1993. Other engineering activities performed during 1993 in support of the ecological studies are also described. DTIC

**N94-37444# Brookhaven National Lab., Upton, NY. ARTERIAL CROSS-SECTION MEASUREMENTS FROM DUAL ENERGY TRANSVENOUS CORONARY ANGIOGRAPHY IMAGES**

D. CHAPMAN and C. SCHULZE 1994 5 p Presented at the 1993 IEEE Nuclear Science Symposium and Medical Imaging Conference, San Francisco, CA, 2-5 Nov. 1993  
(Contract DE-AC02-76CH-00016)  
(DE94-011193; BNL-60385; CONF-931107-37) Avail: CASI HC A01/MF A01

The synchrotron based coronary angiography project at the National Synchrotron Light Source obtains images of coronary arteries using the digital subtraction technique after a distal venous injection of an iodine contrast agent. It allows two areal mass densities to be calculated from these images; one of the iodine and one of the water. Analysis procedures have been developed to arrive at these areal mass densities with corrections to the values being made for detector cross-talk and beam harmonics. From the iodine mass density distribution the relative arterial cross-section area is determined by a line integration across the arterial feature. Results will be given for an iodine tube phantom showing that the relative area of a feature whose lateral dimensions are smaller than the detector pixel resolution can be determined to a few percent. Also, results will be shown from a human image, showing the relative area of the right coronary artery mapped through a region of a previous stenosis subsequently treated by balloon angioplasty. Finally, limitation of the technique and plans to validate and improve the analysis will be discussed. DOE

**N94-37445\* National Aeronautics and Space Administration, Washington, DC. AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 392)**

Sep. 1994 45 p  
(NASA-SP-7011(392); NAS 1.21:7011(392)) Avail: CASI HC A03

This bibliography lists 81 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Sep. 1994. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

**N94-37729# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.**

**COMPARISON OF GASEOUS AND SEMICONDUCTOR DETECTORS FOR MEDICAL IMAGING**

YU. V. ZANEVSKIY 1993 10 p  
(DE94-621344; JINR-E-13-93-204) Avail: CASI HC A02/MF A01 (US Sales Only)

The basic types of gaseous and semiconductor detectors for medical imaging are considered. The goal of the present short review consists in comparing main parameters of these detectors and indicating novel development trends in this research area. DOE

**N94-37233# Louisiana State Univ., Shreveport, LA. CEREBRAL NEUROCHEMICAL MECHANISMS IN STRESS AND ANXIETY Annual Technical Report, 1 Feb. 1993 - 31 Jan. 1994**  
ADRIAN J. DUNN and ARTUR H. SWIERGIEL 28 Feb. 1994 44 p

(Contract F49620-93-1-0125)  
(AD-A280473; AFOSR-94-0366TR) Avail: CASI HC A03/MF A01  
Investigations are concerned with the cerebral mechanisms involved in stress. Current experiments focused on the locus coeruleus noradrenergic (LC-NE) system. In vivo microdialysis studies showed that both hemodynamic stress induced by nitroprusside, and electric footshock increased the apparent release of norepinephrine (NE) in the hypothalamus and prefrontal cortex. The potential role of corticotropin-releasing factor (CRF) in the activation of the LC-NE system was investigated. CRF infused into the LC, but not in surrounding brain structures (such as the par nucleus), increased the apparent synaptic release of cortical NE. This effect was largely unilateral and involved CRF-receptors. We have performed preliminary studies using the new technique of In vivo



voltammetry. These studies have confirmed the increased appearance of extracellular NE following nitroprusside infusion. The superior time resolution of this technique indicated that the NE response to nitroprusside was short-lived. The classic benzodiazepine anxiolytic, chlordiazepoxide (CDP), appeared to diminish the NE response to footshock and may also affect basal NE release. Behavioral studies indicated that activation of NE system with idazoxan almost completely inhibited stress-induced ultrasonic vocalization, with relatively small changes in stress-induced freezing. We failed to find any consistent effects of 6-hydroxydopamine-induced lesions of the dorsal noradrenergic bundle, although vocalization was slightly potentiated. DTIC

**N94-37261#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

**VIRTUAL INTERFACES: RESEARCH AND APPLICATIONS [LES INTERFACES VIRTUELLES ENTRE RECHERCHE ET APPLICATIONS]**

May 1994 186 p In ENGLISH and FRENCH Symposium held in Lisbon, Portugal, 18-22 Oct. 1993 (AGARD-CP-541; ISBN-92-835-0746-0) Copyright Avail: CASI HC A09/MF A02

Recent advances in technologies for information display and sensing of human movements, combined with computer based models of natural and artificial environments, have led to the introduction of so-called virtual interfaces. Virtual interfaces offer increased flexibility and naturalness, so are considered for use in several domains including aviation, training, design, and simulation. Papers presented at this symposium considered issues of research and application in virtual interfaces broadly defined. Issues of technology integration for system development were considered separately from issues of movement monitoring or sensory display. Issues of human performance measurement were presented in the context of both research and application.

**N94-37265#** Centre d'Etudes de la Navigation Aérienne, Toulouse (France).

**ASSISTANCE IN INSTRUCTION AND TRAINING OF AIR TRAFFIC CONTROLLERS [AIDE A LA FORMATION ET L'ENTRAINEMENT DES CONTROLEURS DE TRAFIC AERIEN]** F. MARQUE, T. LABARRERE, and F. NEEL In AGARD, *Virtual Interfaces: Research and Applications* 9 p May 1994 In FRENCH

Copyright Avail: CASI HC A02/MF A02

Under the control of the Center d'Etudes de la Navigation Aérienne (CENA: Air Navigation Study Center), the 'SPEECH' project utilizes the complementary input of industries (STERIA ENGINEERING AND TELECOM, SEXTANT AVIONIQUE and VECSYS) and of a research center (LIMS) in the study and creation of a tool that would assist in the instruction and training of air traffic controllers. Based on the concomitant use of voice interface (synthesis and identification of speech) and of a supervisory system monitoring the dialogue, the prototype is able to rely completely on the audio channel. A validation from the operators of IHM vocal concepts, makes it possible today to consider operational usage of 'SPEECH' within the training process of air traffic controllers. The structure and the various elements of 'SPEECH' are introduced before attempting to evaluate its possible future applications. Details on the methodology used, based on the study of natural language, are also included. Author

**N94-37268#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

**CREATION OF A VIRTUAL WORLD TO STUDY HUMAN SPATIAL PERCEPTION DURING SUSTAINED ACCELERATION** TAMARA L. CHELETTE, ROBERT L. ESKEN, and ERIC J. MARTIN In AGARD, *Virtual Interfaces: Research and Applications* 9 p May 1994

Copyright Avail: CASI HC A02/MF A02

The staff of the Combined Stress Branch has completed the

integration of a system to allow quantitative measurement of perceived attitude while under sustained acceleration. Equipment involved included the computer control system of the Dynamic Environment simulator (DES), a computer generated graphics system, a virtual world helmet mounted display, and a tactile device for reporting attitude perception. The use of a new perceived attitude measurement system in this experiment required not only the technical achievement of the distributed system on the DES, but also required better parameter characterization and basic psychophysical performance studies. In addition, we recorded several confounds and issues concerning the use of a helmet mounted visual system for attitude information as well as head and neck support limitations of such a system. Experimental results include basic psychophysical accuracy and precision, evidence supporting the haptic system sensitivity to a G-excess illusion (even while the vestibular system is maintained at a constant position relative to the G vector), and modeling of pooled response that supports and quantifies the vestibular component of the G-excess illusion. Author

**N94-37278#** Army Aeromedical Research Lab., Fort Rucker, AL. **VISUAL ACCOMMODATION TO VIRTUAL IMAGE DISPLAYS WHEN KNOWLEDGE OF OBJECT DISTANCE CONFLICTS WITH OPTICAL DISTANCE**

JOHN C. KOTULAK, STEPHEN E. MORSE, and ROGER W. WILEY In AGARD, *Virtual Interfaces: Research and Applications* 4 p May 1994

Copyright Avail: CASI HC A01/MF A02

In virtual image displays, the image is typically at or near optical infinity, while the object may be at any distance. This can create a conflict between the known distance of a target and its optical distance. If accommodation is drawn to the known distance of the object rather than the optical distance of its image, considerable retinal image blur can result. To determine whether this actually occurs, we measured the accommodation of seven young adult subjects with a dynamic infrared optometer. The subjects viewed a collimated virtual image of a target monocularly through third generation night vision goggles (ANVIS). Although the target itself was positioned randomly at either 6.0, 1.0, 0.5, or 0.33 m from the observer, its image was maintained at infinity by compensatory adjustments of the ANVIS objective lens. The observer was aware fully of the actual distance of the target. A simulated clear starlight night sky condition was used in order to degrade image quality such that the accommodative feedback loop was semi-open, an intermediate state between the closed and open loop conditions of previous experiments. The results show that for some subjects, knowledge of object distance is a more powerful cue for accommodation than the image's optical distance; however, for the majority of subjects, this is not the case. The subjects who were susceptible to the knowledge of object distance cue reported severe blur when the object was nearby. We also found that these same subjects, i.e., the susceptible ones, tend to have a more proximal dark focus than those whose accommodation is not influenced by knowledge of object distance. The linkage between dark focus and susceptibility to proximal influences has not been previously demonstrated and needs to be explored further. Author

**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

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

**A94-61792**

**HUMAN ENGINEERING FOR THE SPACE STATION** REGINALD M. MACHELL McDonnell-Douglas Aerospace, JAMES L. LEWIS, JACK STOKES, and STEVEN B. HALL *Aerospace America* (ISSN 0740-722X) vol. 31, no. 10 October 1993 p. 22-25

(BTN-94-EIX94401217883) Copyright

The international space station is being designed for missions in which crews will conduct scientific experiments and technology applications in space. Station components must be launched in the cargo bay of the Space Shuttle, whose crew will use telerobotic manipulators and extravehicular activity (EVA) to assemble the station components on orbit. Human engineering design standards were established early in the space station program to maximize crew safety and productivity. This paper shows how human factors affected the selection of the basic module architecture, the design of the lab and habitation modules, the workstation designs, the visual display architecture, the EVA worksite design, and the verification of crew-machine interfaces. EI

**A94-61793\*** National Aeronautics and Space Administration, Washington, DC.

#### HUMAN FACTOR IN AEROSPACE MAINTENANCE

FRANCES E. MOUNT NASA, Washington *Aerospace America* (ISSN 0740-722X) vol. 31, no. 10 October 1993 9 p (BTN-94-EIX94401217884) Copyright

Aerospace maintenance is a critical field that depends on the availability of highly trained personnel. These workers must develop skills that allow a minimum of errors and make the most efficient use of time, since many aerospace operations are costly and time-critical. The 21st century maintenance manager will be responsible for maintaining extremely complex and computer-intensive systems at a time when skilled workers are expected to be in short supply. In the aircraft industry, the trend has been toward more demanding jobs. As aircraft and their onboard systems have grown more capable, maintenance support has grown more complex. Dwindling numbers of qualified young people, rapidly changing technology, and ever-increasing skill requirements make it imperative that action be taken now to address future maintenance needs. Education and training are the keys to making a cost-effective fit between workers and their jobs. Where the educational level of available workers is inadequate, industry will have to continue providing basic education as entry-level training. Retention of competent people will often depend on industry-provided training and retraining. EI

**A94-61794**

#### HUMAN/ROBOT INTERFACE

STEVEN F. WIKER Washington Univ. *Aerospace America* (ISSN 0740-722X) vol. 31, no. 10 October 1993 p. 30-33 (BTN-94-EIX94401217885) Copyright

Human factors engineers have found the teaming of humans and remote robotic systems particularly challenging. With rare exceptions, their understanding of human performance and human-machine interaction was founded on studies of young and typically well rested subjects who had normal perceptual, cognitive, and motor faculties. Also, current human factors design guidelines are based largely on studies in which only a few design characteristics of a control or display system were manipulated or studied at any given time. To diminish such problems and to ease these devices' entry into space and terrestrial markets, today's teleroboticists have adopted new strategies. First, anthropomorphism has been abandoned as a strict icon for design. End effectors no longer need resemble the human hand in form and kinematic behavior to be considered operationally effective. Also, most designers agree that telerobotic performance depends on the interplay of a mixture of displays, controls, actuators, and other component technologies. Thus, both initial designs and subsequent engineering tradeoff decisions are based on test findings and empirical performance models rather than on intuition. Finally, hardware and software maintainability and operator training issues are now receiving much greater consideration when candidate designs are evaluated. EI

**A94-61795**

#### HUMAN FACTORS IN UNDERWATER SYSTEMS

DUDLEY CROSSON *Aerospace America* (ISSN 0740-722X) vol. 31, no. 10 October 1993 p. 36-37 (BTN-94-EIX94401217886) Copyright

Interest in human factors has grown significantly in the past 20 years. Although the field had its genesis in the aerospace industry, it has begun receiving greater attention in the undersea engineering community as well. The reason for this interest in underwater systems is twofold: technology is advancing at an incredibly rapid rate; and advanced technologies from other fields are being applied to underwater activities. This paper reviews the development of diving systems, submersibles, and remotely operated vehicles (ROV) from a human factors standpoint. EI

**A94-61796**

#### SIMULATION CONSIDERS THE HUMAN FACTORS

C. J. ARBAK McDonnell-Douglas Aerospace-East, P. A. DERENSKI, and L. C. WALRATH *Aerospace America* (ISSN 0740-722X) vol. 31, no. 10 October 1993 p. 38-41 (BTN-94-EIX94401217887) Copyright

Human factors professionals must ensure that all aspects of a simulation that involve humans are appropriate to their purpose. At McDonnell Douglas Aerospace-East, flight simulation is an integral part of product development. Human factors methods are applied during preliminary design to such issues as crew size and crew station geometry, initial allocation of tasks, preliminary control and display requirements, and preliminary design of the crew station and flight simulator. The simulation tools used at this stage include analytical and mathematical techniques, part-task lab simulations, and low-fidelity reconfigurable simulations. In addition, rapid prototyping methods, which occupy a middle ground between mathematical or part-task methods and complete hardware cockpits, are also used. EI

**N94-36623#** Naval Air Warfare Center, Warminster, PA. Aircraft Div.

#### ADVANCED HELMET TRACKING TECHNOLOGY DEVELOPMENTS FOR NAVAL AVIATION

JAMES H. BRINDLE In AGARD, Pointing and Tracking Systems 15 p May 1994 Copyright Avail: CASI HC A03/MF A02

There is a critical need across the Services to improve the effectiveness of aircrew within the crewstation by capitalizing on the natural psycho-motor skills of the pilot through the use of a variety of helmet-mounted visual display and control techniques. This has resulted in considerable interest and significant ongoing research and development efforts on the part of the Navy, as well as the Army and the Air Force, in the technology building blocks associated with this area, such as advanced head tracking technologies, helmet-mounted display optics and electronics, and advanced night vision or image intensification technologies. Advanced multi-mode visually-coupled systems combine the attributes of image intensification with those of the helmet-mounted display capabilities for symbology and thermal sensor presentation. Examples of this class of system could be something as simple as the night vision goggle HUD, or NVG-HUD, which combines head tracking, image intensification, and simple symbology overlay, to the more complex multi-mode systems with high resolution miniature CRT's. This class of systems is capable of presenting to the pilot correlated, spatially-referenced information from both the image intensification technology, as well as a dynamic, high fidelity symbology overlay, and correlated thermal sensor imagery. Derived from text

**N94-36624#** General Electric Co. Ltd., Edinburgh (Scotland). Display Systems Group.

#### ADVANCES IN HELMET TRACKERS

W. M. ASPIN In AGARD, Pointing and Tracking Systems 4 p May 1994 Copyright Avail: CASI HC A01/MF A02

The object of this paper is to describe in general, some recent developments in helmet tracking devices and, to detail the design of a particular optically based system. Author

**N94-36632#** Aleria Aeronautica, Turin (Italy). System Technology Dept. STUDIES AND SIMULATIONS ON SENSOR FUSION AND



**CUEING FOR FIGHTER APPLICATION**

M. AVALLE *In* AGARD, *Pointing and Tracking Systems* 8 p  
May 1994

Copyright Avail: CASI HC A02/MF A02

A method to implement the sensor fusion and sensor cueing on an advanced fighter aircraft is described in this paper. Starting from a short introduction concerning the general aspects and theory of sensor fusion, the paper presents some choices adopted during the development of the sensor fusion process at ALENIA DVD System Technology Dept. Sensor cueing will be also introduced and some particular cases of interest for a fighter aircraft will be discussed. The performances of the adopted solutions are then discussed on the basis of some experimental results obtained using a simulation tool. An evaluations of the overall sensor fusion process performance and some considerations about possible alternatives will conclude the work. Author

**N94-36838\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**SELECTIVELY LOCKABLE KNEE BRACE Patent Application**  
NEILL MYERS, inventor (to NASA), MIKE SHADOAN, inventor (to NASA), JOHN FORBES, inventor (to NASA), and KEVIN BAKER, inventor (to NASA) 25 May 1994 17 p  
(NASA-CASE-MFS-28991-1; NAS 1.71:MFS-28991-1; US-PATENT-APPL-SN-252032) Avail: CASI HC A03/MF A01

A knee brace for aiding in rehabilitation of damaged leg muscles includes upper and lower housings, normally pivotable, one relative to the other about the knee joint axis of a patient. The upper housing is attachable to the thigh of the patient above the knee joint, while the lower housing is secured to a stirrup which extends downwardly along the patient's leg and is attached to the patient's shoe. An actuation rod is carried within the lower housing and is coupled to a cable. The upper and lower housings carry cooperative clutch/brake elements which normally are disengaged to permit relative movement between the upper and lower housings. When the cable is extended, the clutch/brake elements engage and lock the housings together. A heel strike mechanism fastened to the stirrup and the heel of the shoe is connected to the cable to selectively extend the cable and lock the brace in substantially any position when the patient places weight on the heel. NASA

**N94-36840\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**CHANNEL IN HIP IMPLANT STEM Patent Application**  
FRANCISCO CANABAL, III, inventor (to NASA) 20 May 1994 11 p

(NASA-CASE-MFS-28987-1; NAS 1.71:MFS-28987-1; US-PATENT-APPL-SN-252615) Avail: CASI HC A03/MF A01

A hip implant prosthesis has a femoral stem cemented into a cavity reamed in the femur bone of a person undergoing the transplant, the stem having an elongated central channel extending the entire length of the stem. During the implantation process the cavity is filled with bone-cement and as the stem is inserted the space between the stem and the cavity wall of the femur is closed, preferably by an elastomeric ring, so that the surplus cement is forced to flow out through the channel. Other channels may be formed in the stem from the outer end and opening onto the cavity at the enlarged portion of the stem. By restricting the flow of surplus cement in this manner, vortices and other undesirable flow characteristics of the surplus cement exiting the cavity are eliminated or minimized so that structural faults in the solidified cement are minimized. NASA

**N94-37262\*** Syracuse Univ., NY. Center for Science and Technology.

**TASK-SPECIFIC USABILITY REQUIREMENTS FOR VIRTUAL INFORMATION ENVIRONMENTS: INTERFACE DESIGN AND DATA REPRESENTATION FOR HUMAN OPERATORS OF COMPLEX MEDICAL SYSTEMS**

MICHAEL S. NILAN *In* AGARD, *Virtual Interfaces: Research and Applications* 8 p May 1994 Sponsored in part by New

York State Center for Advanced Technology in Computer Applications and Software Engineering; Alex Nason Foundation of New York City; and AFOSR

Copyright Avail: CASI HC A02/MF A02

The National Research Council has identified 'usability' as one of two major requirements for coherent development of computer and information systems over the next ten years. The use of multisensory virtual environment technology to display and provide access to system functions and data relevant to large-scale, complex, potentially volatile medical tasks (e.g., telepresence surgery) increases the (already critical) need for unobtrusive, transparent interface designs, and data representations. Unfortunately, the medical community must take responsibility for providing requirements specifications to the computer industry or else be forced to adapt to existing technical constraints. Recent research in interface design and data organization/representation for two dimensional computer applications indicates that dynamic representations of the specific task or problem that the human operator is performing is very effective. Employing a task-specific, 'user-based' methodology, steps in the task resolution are organized into a dynamic model of the task. Linked to this model are the functional system requirements and information/data need requirements divided into specific content requirements, display requirements (including spatial organization) and system help requirements. The resultant model is readily interpretable by system designers and in addition, provides them with specific task-related system evaluation criteria. Usability advantages of dynamic task representations include: minimal system/application training requirements for operators; and coherent, comprehensible, and uncluttered sensory field organization of system functions, relevant data, and help information. Because of its ability to provide specific task-related requirements to system designers, this methodological approach will insure maximum usability of high performance computing (including virtual reality technology) for critical medical applications. Author

**N94-37264\*** Physics and Electronics Lab. TNO, The Hague (Netherlands). High Performance Computing.

**ON THE FEASIBILITY OF VIRTUAL ENVIRONMENTS IN MEDICINE**

A. C. M. DUMAY and G. J. JENSE *In* AGARD, *Virtual Interfaces: Research and Applications* 8 p May 1994

Copyright Avail: CASI HC A02/MF A02

Virtual Environments (VE) allow a human to interact with a (computer) system in such a way that a high level of presence in a computer-synthesized world is experienced. In principle, all human senses are involved with the interaction. Many applications may benefit from this type of human-machine interfacing, however, little have emerged so far for medicine. In this paper, we elaborate on some realistic potential applications of virtual environment technology in the field of medicine. These applications can be found in education/training, therapy, surgery, rehabilitation, diagnosis, telemedicine, and biomechanics. The value to be added to these applications by VE technology lies in the fact that patient data or patient models may be moderated to the physician in a more intuitive and natural manner. Despite these potentials, the short-term feasibility of these applications can be put into question for various reasons. Firstly, the current generation of display devices have a resolution that may show to be too low to achieve a sufficiently high degree of realism for medical applications. Secondly, there are no commercially-available actuators for tactile and force feedback which the physician desperately need for the simulation of the contact with the (virtual) patient. Thirdly, the enormous computing power required for these applications needs (yet) a considerable investment. With these limitations in mind, we believe that we are at the cradle of a whole new generation of VE applications in medicine. Author

**N94-37266\*** Sextant Avionique, Saint Medard en Jalles (France).

**INTERACTIVE LARGE SCREEN: A MULTI-MODE DIALOGUE TOOL FOR FUTURE COCKPITS [LE GRAND ECRAN**

**INTERACTIF: UN OUTIL DE DIALOGUE MULTIMODAL POUR LES FUTURES CABINES DE PILOTAGE]**

B. BARBIER, E. FILIATRE, and I. IRIGARAY *In* AGARD, *Virtual Interfaces: Research and Applications* 4 p May 1994 *In* FRENCH

Copyright Avail: CASI HC A01/MF A02

The experimental make-up described here is constituted of a large size projection screen displaying an image on which an operator acts in real time, under control of a specific dialogue software, using several control devices (speech recognizer, numeric data glove, oculometer). Various human communication channels are then simultaneously used: vision and audition for the system-to-man flow; voice, gesture, and gaze for the man-to-system flow. Various ways of using and associating these communication channels allow to elaborate a multimodal dialogue. Author

**N94-37267#** Groningen Rijksuniv. (Netherlands). Traffic Research Centre.

**IMMERSIVE VIRTUAL ENVIRONMENTS AS TRAINER: SYSTEM DESIGN FROM A COGNITIVE STANCE**

M. WIERDA, P. C. VANWOLFFELAAR, and W. VANWINSUM *In* AGARD, *Virtual Interfaces: Research and Applications* 6 p May 1994 Sponsored by Ministry of Transport and Public Works Copyright Avail: CASI HC A02/MF A02

Many of today's training-simulators for guiding, steering, or flying a vehicle are designed to have a safe, environmentally clean, flexible and cost effective educational environment. It is claimed that the training effectiveness can be increased significantly if the starting point of the design would be shifted from the 'enabling technology' position to a cognitive approach of the task to be learned in the simulator. An outline is given of this approach, encompassing a behavioral task-analysis, a cognitive process model, and an analysis of the educational goals in terms of cognitive and perceptual skills. It is concluded that knowledge in the domains of cognitive science and artificial intelligence is hardly used while this knowledge may bring about training simulators of a significantly other quality. Author

**N94-37269#** Defence Research Agency, Farnborough, Hampshire (England). Flight Systems Dept.

**THE DRA VIRTUAL COCKPIT RESEARCH PROGRAM**

JUDITH INESON *In* AGARD, *Virtual Interfaces: Research and Applications* 12 p May 1994 Sponsored by Ministry of Defence Copyright Avail: CASI HC A03/MF A02

The aim of this paper is to describe work in progress at the Defence Research Agency (DRA) Farnborough on the Virtual Cockpit, with particular emphasis on format design and development. The paper reviews the reasons why the concept of the Virtual Cockpit is of interest, and the ways in which it differs from the common understanding of Virtual Reality. The potential advantages and disadvantages of such a man-machine interface are discussed. The overall aims of the DRA Virtual Cockpit research program are listed, together with a more detailed discussion of the areas of concern in the presentation of visual information. The current status of the research program is described. The hardware being used for this program comprises a head-coupled binocular helmet-mounted display (HMD) system in a skeletal cockpit rig with stereoscopic, computer generated graphics, and a set of demonstration formats showing examples of the type of imagery which might be employed in a Virtual Cockpit. This is followed by a description of APHIDS (Advanced Panoramic Helmet Interface Demonstrator System) - a more capable Virtual Cockpit research rig currently being built for DRA, and of its strengths and limitations. The paper concludes with an outline of how APHIDS will be employed in the next stage of the research program. Author

**N94-37270#** DIVISION Ltd., Almondsbury, Bristol (England). **VIRTUAL REALITY EVOLUTION OR REVOLUTION**

CHARLES GRIMSDALE *In* AGARD, *Virtual Interfaces: Research and Applications* 4 p May 1994

Copyright Avail: CASI HC A01/MF A02

There is a growing body of research which can now lead us to a strong rationale for Virtual Reality as the next generation of Human Computer Interface. As an interface metaphor Virtual Reality clearly has great potential, throughout industry, commerce, and leisure. But how will it gain acceptance. It is my belief that this will be a process of evolution rather than revolution. Much has been written about the limitations of underlying computer systems, and 3D peripherals but there is a fundamental need for more powerful and flexible software upon which to build this new generation interface. Author

**N94-37271#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Engineering Div.

**MANUAL TRACKING PERFORMANCE USING A VIRTUAL HAND CONTROLLER: A COMPARISON STUDY**

ROBERT G. EGGLESTON, WILLIAM P. JANSON, and SRIDHAR ADAPALLI *In* AGARD, *Virtual Interfaces: Research and Applications* 7 p May 1994

Copyright Avail: CASI HC A02/MF A02

This study compares a virtual hand controller (magnetic sensor attached to a glove) with a physical displacement stick in a single-axis manual control task. Three different control/display (C/D) ratios were used with each controller. Control performance was found to vary significantly with C/D ratio. When across-device comparisons were made at identical C/D ratios, a slight but significant performance advantage was found for the displacement stick at one C/D level. When between-device comparisons were made on the basis of a performance matching technique, the results were comparable for the virtual and physical hand controllers. The issue of how to best match test conditions to achieve an unbiased comparison of control devices is addressed. Arguments are advanced in favor of using the performance based matching technique. From this perspective, the data are interpreted to support the claim that comparable manual control performance can be achieved with a virtual hand controller. Author

**N94-37272#** Mooij and Associates, Oegstgeest (Netherlands). **A NON-INTRUSIVE WAY TO MEASURE POINT-OF-GAZE**

G ZON, D. R., H. A. MOOIJ, and J. BOUWENS *In* AGARD, *Virtual Interfaces: Research and Applications* 8 p May 1994

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OBSERVER is an instrument for obtaining data about where a subject is looking on fixed user specified surfaces. Since the processing of data takes place in real time, this instrument can be used to indicate areas of interest just by looking at them. In this paper, after an introduction on the application of point-of-gaze (POG) data, the OBSERVER system is described. Attention is given to subsystems as well as to calibration. As the first application of OBSERVER, that of a measuring instrument, an 'eye-witness quality experiment' is discussed. Author

**N94-37273#** SR Research, Toronto (Ontario). **OPERATOR GAZE POSITION CONTROL INTERFACES: INVESTIGATION OF PSYCHOPHYSICAL AND OPERATIONAL PARAMETERS**

DAVE M. STAMPE, EYAL M. REINGOLD, and JULIUS J. GRODSKI *In* AGARD, *Virtual Interfaces: Research and Applications* 9 p May 1994

Copyright Avail: CASI HC A02/MF A02

Real-time monitoring of an operator's gaze position on a computer display of response options may form an important element of future computer interfaces and teleoperation control systems. In one implementation, the gaze position can serve as a pointer, and a critical length of gaze serves as selection, leaving the operator's hands free for other tasks. Control tasks such as multiple option selection, or looking for targets embedded within a picture are especially suited to selection by gaze position monitoring, since the search usually terminates on the object to be selected. More complex control functions can be implemented through multilevel 'menus' of choices. In the past, gaze monitoring systems restricted operator movement or required head restraints. The newest generation of gaze tracking systems allow free head movement and

accurate gaze position monitoring over extended periods and are highly suited for control applications. Although gaze position control systems have been tried with moderate success in the past, little systematic investigation of the human parameters of gaze position control has been performed. In the present research program, important parameters of gaze selection such as fixation position accuracy, selection error rates, and the effects of real-time gaze position feedback were investigated. Experimental results will be used to suggest guidelines for creation and use of gaze position response in control interfaces. Author

**N94-37274#** Centre d'Essais en Vol, Bretigny-sur-Orge (France). Lab. de Medecine AeroSpatiale.

**GAZE ORIENTATION UNDER G(Z)-LOAD. METHODOLOGICAL ASPECTS: PRELIMINARY RESULTS [ORIENTATION DU REGARD SOUS FACTEUR DE CHARGE. ASPECTS METHODOLOGIQUES: RESULTATS PRELIMINAIRES]**

PATRICK B. SANDOR, ISABELLE HORTOLLAND, FREDERIC POUX, and ALAIN LEGER *In* AGARD, Virtual Interfaces: Research and Applications 7 p May 1994 *In* FRENCH Copyright Avail: CASI HC A02/MF A02

Gaze in head-free condition was computed under G(sub z)-load. Eye movements were measured with an oculometer using the pupil-to-corneal reflex method. Head movements were measured with an electro-optic system. The subject's head was at the center of a hemisphere (diameter 1.80 m). The internal face of this hemisphere was forming a screen on which a laser spot was to be projected. The subject's line-of-sight was computed, i.e. the direction of the eyeball in the head frame, which is mobile relative to the space. A procedure of correction of the parallax error allowed the determination of the point-of-gaze, which is the intersection point of the LDV with the screen. After static validation, two pilot experiments were performed under low G(sub z)-load. Results showed feasibility of the method in the experimental environment, and pursuit errors were quantified. Improvements are proposed. Author

**N94-37275#** British Aerospace Aircraft Group, Bristol (England). Human Factors Dept.

**A COMPARISON OF TWO EXAMPLES OF MAGNETIC TRACKER SYSTEMS**

M. WILLIAMS *In* AGARD, Virtual Interfaces: Research and Applications 19 p May 1994 Copyright Avail: CASI HC A03/MF A02

This paper is an account of an investigation of the performance of various position measuring devices which use low frequency AC or pulsed DC magnetic fields. They are used in many applications in computer graphics, and now for virtual reality, where it is necessary to estimate the observer's direction of gaze. As part of the Sowerby Research Center's program of eye movement research one such system is being integrated with a video based eye-tracker. There seems to be no independent, published assessment covering all aspects of all the systems which are of interest to this research program. This paper aims to fill that gap: it includes information relating to the static performance of two measuring systems: the 3-Space Polhemus Tracker and the Ascension Technologies' 'Bird'. The measurements relate to repeatability, noise, cross-talk, stability, range, and linearity. The influence of metal objects close to the transducers is also investigated. In most respects the 'Bird' sensor was found to be more appropriate for this application. Author

**N94-37281\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**THE USE OF A TACTILE INTERFACE TO CONVEY POSITION AND MOTION PERCEPTIONS**

A. H. RUPERT (Naval Aerospace Medical Research Lab., Pensacola, FL.), F. E. GUEDRY (Naval Aerospace Medical Research Lab., Pensacola, FL.), and M. F. RESCHKE *In* AGARD, Virtual Interfaces: Research and Applications 7 p May 1994 Sponsored by Naval Medical Research and Development Command Copyright Avail: CASI HC A02/MF A02

Under normal terrestrial conditions, perception of position and motion is determined by central nervous system integration of concordant and redundant information from multiple sensory channels (somatosensory, vestibular, visual), which collectively yield vertical perceptions. In the acceleration environment experienced by the pilots, the somatosensory and vestibular sensors frequently present false information concerning the direction of gravity. When presented with conflicting sensory information, it is normal for pilots to experience episodes of disorientation. We have developed a tactile interface that obtains vertical roll and pitch information from a gyro-stabilized attitude indicator and maps this information in a one-to-one correspondence onto the torso of the body using a matrix of vibrotactors. This enables the pilot to continuously maintain an awareness of aircraft attitude without reference to visual cues, utilizing a sensory channel that normally operates at the subconscious level. Although initially developed to improve pilot spatial awareness, this device has obvious applications to 1) simulation and training, 2) nonvisual tracking of targets, which can reduce the need for pilots to make head movements in the high-G environment of aerial combat, and 3) orientation in environments with minimal somatosensory cues (e.g., underwater) or gravitational cues (e.g., space). Author

**N94-37347** Federal Aviation Administration, Cambridge, MA. National Transportation Systems Center.

**HUMAN FACTORS FOR FLIGHT DECK CERTIFICATION PERSONNEL Final Report, Jun. 1989 - Sep. 1992**

KIM M. CARDOSI and M. S. HUNTLEY Jul. 1993 418 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality (AD-A280477; DOTVNTSC-FAA-93-4; DOT/FAA/RD-93/5) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This document is a compilation of proceedings and lecture material on human performance capabilities that was presented to FAA flight deck certification personnel. A five-day series of lectures was developed to provide certification specialists with information on fundamental characteristics of the human operator that are relevant to flight deck operations. The series was designed to proceed from the presentation of basic information on human sensory capabilities, through human cognition, to the application of this knowledge to the design of controls and displays in the automated cockpit. The initial lectures were prepared and presented by published academic researchers. The later ones were presented by senior human factors practitioners employed by major American airframe manufacturers. DTIC

**N94-37458\*#** Tulane Univ., New Orleans, LA. Dept. of Mechanical Engineering.

**METHODOLOGIES TO DETERMINE FORCES ON BONES AND MUSCLES OF BODY SEGMENTS DURING EXERCISE, EMPLOYING COMPACT SENSORS SUITABLE FOR USE IN CROWDED SPACE VEHICLES Semiannual Status Report**

FERNANDO FIGUEROA 20 Jul. 1994 6 p (Contract NAG9-720) (NASA-CR-196272; NAS 1.26:196272) Avail: CASI HC A02/MF A01

A complete description of an instrumented ergometer system, including the sensors, the data acquisition system, and the methodologies to calculate the kinematic parameters were initially developed at Tulane University. This work was continued by the PI at NASA Johnson Space Center, where a flight ergometer was instrumented and tested during a KC-135 Zero-Gravity flight. The sensors that form part of the system include EMG probes and accelerometers mounted on the subject using the ergometer, load cells to measure pedal forces, and encoders to measure position and orientation of the pedal (foot). Currently, data from the flight test is being analyzed and processed to calculate the kinematic parameters of the individual. The formulation developed during the initial months of the grant will be used for this purpose. The system's components are compact (all sensors are very small). A salient feature of the system and associated methodology to determine the

kinematics is that although it uses accelerometers, position is not determined by integration. Position is determined by determining the angle of two frames of reference for which acceleration at one point is known in coordinates of both frames. Author

**N94-37741#** Starmark Corp., Arlington, VA.  
**CIVIL USE OF NIGHT VISION DEVICES: EVALUATION PILOT'S GUIDE, PART 1** Final Report

DAVID L. GREEN Jul. 1994 60 p Prepared for Systems Control Technology, Inc., Arlington, VA  
 (SCT-91RR-43; DOT/FAA/RD-94/18) Avail: CASI HC A04/MF A01

This document was developed to aid in the evaluation of the use of night vision goggles by civil helicopter pilots. This report was used to prepare pilots to participate in the flight test program. The principal task was to determine if there are any unresolved safety issues that would preclude pilot's use of NVG's during helicopter operations under Federal Aviation Regulations Parts 91 or 135. Certainly NVG's can enable a pilot to 'see better' at night and to accomplish certain flight objectives. However, the question is whether safety is degraded during any phase of the flight operation if pilots use these devices. Even if the use of NVG's dramatically improves operational effectiveness, current safety margins must be maintained or improved during all phases of flight. Author (revised)

**N94-37742#** Systems Control Technology, Inc., Arlington, VA.  
**NIGHT VISION GOGGLES IN EMERGENCY MEDICAL SERVICE (EMS) HELICOPTERS** Final Report

WILLIAM T. SAMPSON, GARY B. SIMPSON, and DAVID L. GREEN Jul. 1994 90 p  
 (Contract DTFA01-87-C-00014)  
 (SCT-93RR-22; DOT/FAA/RD-94/21) Avail: CASI HC A05/MF A01

This document addresses the potential use of night vision goggles (NVG's) by the emergency medical service (EMS) industry. Key issues analyzed are the night environment, physiology of the eye, characteristics of night vision devices, maintenance of the NVG, and night operations. Pilots from the government and EMS industry participated in a flight program at the FAA Technical Center to assess the capabilities and utility of NVG's in EMS scenarios. The results of the tests are incorporated in the recommendations of this document. Information produced by other government agencies, with extensive experience with NVG's, was reviewed for use in this application and incorporated into the text. This investigation concludes that NVG's are a viable tool during en route and terminal operations during certain EMS scenarios. The NVG, when properly used, can increase safety, enhance situational awareness, and reduce pilot workload and stress normally associated with night operations. Author

**N94-37743#** Starmark Corp., Arlington, VA.  
**ASSESSMENT OF NIGHT VISION GOGGLE WORKLOAD: FLIGHT TEST ENGINEER'S GUIDE** Final Report

DAVID L. GREEN Jul. 1994 78 p Prepared for Systems Control Technology, Inc., Arlington, VA  
 (SCT-91RR-45; DOT/FAA/RD-94/20) Avail: CASI HC A05/MF A01

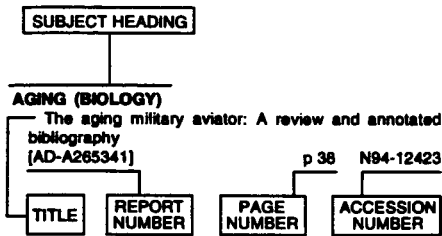
This document was developed to aid in the evaluation of the use of night vision goggles (NVG's) by civil helicopter pilots. This report was used to prepare pilots to participate in the flight test program. The principal task was to determine if there are any unresolved safety issues that would preclude pilot use of NVG's during helicopter operations under Federal Aviation Regulations Parts 91 or 135. Certainly NVG's can enable a pilot to 'see better' at night and to accomplish certain flight objectives. However, the question is whether safety is degraded during any phase of the flight operation if pilots use these devices. Even if the use of NVG's dramatically improves operational effectiveness, current safety margins must be maintained or improved during all phases of flight. Author (revised)

**N94-37812** Centre National de la Recherche Scientifique, Marseilles (France).  
**POSTURAL STRATEGIES FOR THE CONTINUOUS CONTROL**

**OF STATIC AND DYNAMIC BALANCE IN MAN** Final Report  
**[LES STRATEGIES POSTURALES DE CONTROLE CONTINU DEL'EQUILIBRE STATIQUE ET DYNAMIQUE CHEZ L'HOMME]**  
 S. MESURE 1994 54 p In FRENCH Sponsored by Direction des Recherches, Etudes et Techniques and Centre de Documentation de l'Armement  
 (PB94-184678) Avail: Issuing Activity (National Technical Information Service (NTIS))

The authors tested the hypothesis that athletically trained subjects adjust their posture better to control balance than novices. Men and women of both groups were tested in a sharpened Romberg position, on either hard or soft surfaces with various types of lighting, or on seesaws with and without blindfolds. Acceleration meters measured body sway at the head, hips, and ankles. Frequency power spectrum analysis for both experiments showed that experts had better postural control. Cross-correlation functions (CCF's) were applied to simultaneous acceleration meter measurements to statistically determine the coordination of movements between two anatomical levels. CCF results showed that novices employ different relative body movements during static equilibrium, as shown by lateral head-hips significant CCF peaks. Quasi-dynamic results on the seesaws also showed better postural control in experts, but were tougher to analyze in terms of CCF's. The only significant difference in blindfolded performance was that novices fell more often. Results show clearly that the practice of a sport produces better postural balance. NTIS

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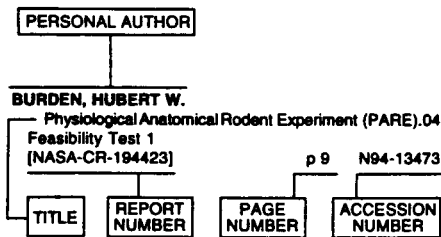
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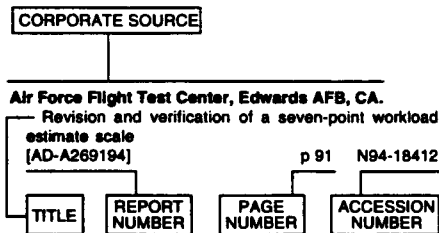
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November 1994

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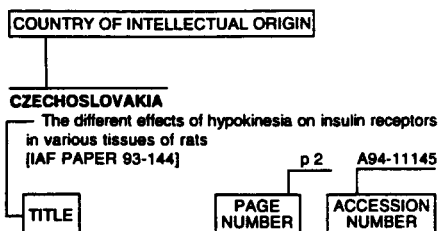


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AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 394)

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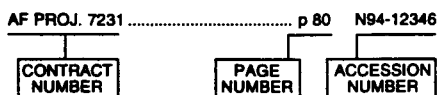
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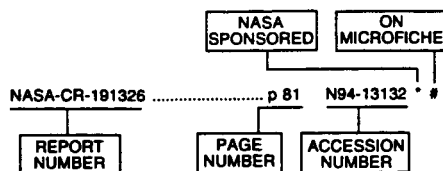


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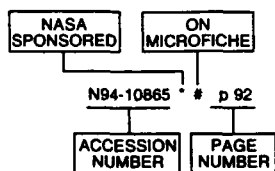
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Grand Forks

## OHIO

### STATE LIBRARY OF OHIO

Documents Dept.  
65 South Front Street  
Columbus, OH 43266  
(614) 644-7051 Fax: (614) 752-9178

## OKLAHOMA

### OKLAHOMA DEPT. OF LIBRARIES

U.S. Govt. Information Div.  
200 NE 18th Street  
Oklahoma City, OK 73105-3298  
(405) 521-2502, ext. 252, 253  
Fax: (405) 525-7804

### OKLAHOMA STATE UNIV.

Edmon Low Library  
Documents Dept.  
Stillwater, OK 74078  
(405) 744-6546 Fax: (405) 744-5183

## OREGON

### PORTLAND STATE UNIV.

Millar Library  
934 SW Harrison - P.O. Box 1151  
Portland, OR 97207  
(503) 725-3673 Fax: (503) 725-4527

## PENNSYLVANIA

### STATE LIBRARY OF PENN.

Govt. Publications Section  
Walnut St. & Commonwealth Ave. -  
P.O. Box 1601  
Harrisburg, PA 17105  
(717) 787-3752

## SOUTH CAROLINA

### CLEMSON UNIV.

Cooper Library  
Public Documents Unit  
Clemson, SC 29634-3001  
(803) 656-5174 Fax: (803) 656-3025  
In cooperation with Univ. of South  
Carolina, Thomas Cooper Library,  
Columbia

## TENNESSEE

### MEMPHIS STATE UNIV. LIBRARIES

Govt. Documents  
Memphis, TN 38152  
(901) 678-2586 Fax: (901) 678-2511

## TEXAS

### TEXAS STATE LIBRARY

United States Documents  
P.O. Box 12927 - 1201 Brazos  
Austin, TX 78711  
(512) 463-5455 Fax: (512) 463-5436

### TEXAS TECH. UNIV. LIBRARY

Documents Dept.  
Lubbock, TX 79409  
(806) 742-2268 Fax: (806) 742-1920

## UTAH

### UTAH STATE UNIV.

Merrill Library & Learning Resources  
Center, UMC-3000  
Documents Dept.  
Logan, UT 84322-3000  
(801) 750-2684 Fax: (801) 750-2677

## VIRGINIA

### UNIV. OF VIRGINIA

Alderman Library  
Govt. Documents  
Charlottesville, VA 22903-2498  
(804) 824-3133 Fax: (804) 924-4337

## WASHINGTON

### WASHINGTON STATE LIBRARY

Document Section  
MS AJ-11  
Olympia, WA 98504-0111  
(206) 753-4027 Fax: (206) 753-3546

## WEST VIRGINIA

### WEST VIRGINIA UNIV. LIBRARY

Govt. Documents Section  
P.O. Box 6069  
Morgantown, WV 26506  
(304) 293-3640

## WISCONSIN

### ST. HIST. SOC. OF WISCONSIN LIBRARY

Govt. Publications Section  
816 State Street  
Madison, WI 53706  
(608) 262-2781 Fax: (608) 262-4711  
In cooperation with Univ. of Wisconsin -  
Madison, Memorial Library

### MILWAUKEE PUBLIC LIBRARY

Documents Div.  
814 West Wisconsin Avenue  
Milwaukee, WI 53233  
(414) 278-2167 Fax: (414) 278-2137

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