INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 152 reports, articles and other documents originally announced in May 1991 in *Scientific and Technical Aerospace Reports* (STAR) or in *International Aerospace Abstracts* (IAA). The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

\[
\begin{align*}
\text{STAR (N-10000 Series)} & : \text{N91-16988} - \text{N91-19023} \\
\text{IAA (A-10000 Series)} & : \text{A91-24169} - \text{A91-28400}
\end{align*}
\]

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

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

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


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

<table>
<thead>
<tr>
<th>Category</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 51</td>
<td>Life Sciences (General)</td>
<td>103</td>
</tr>
<tr>
<td>Category 52</td>
<td>Aerospace Medicine</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.</td>
<td></td>
</tr>
<tr>
<td>Category 53</td>
<td>Behavioral Sciences</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.</td>
<td></td>
</tr>
<tr>
<td>Category 54</td>
<td>Man/System Technology and Life Support</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>Includes human engineering; biotechnology; and space suits and protective clothing.</td>
<td></td>
</tr>
<tr>
<td>Category 55</td>
<td>Space Biology</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Includes exobiology; planetary biology; and extraterrestrial life.</td>
<td></td>
</tr>
</tbody>
</table>

Subject Index ................................................................. A-1
Personal Author Index ......................................................... B-1
Corporate Source Index ....................................................... C-1
Foreign Technology Index ..................................................... D-1
Contract Number Index ........................................................ E-1
Report Number Index ............................................................ F-1
Accession Number Index ....................................................... G-1
Appendix ................................................................. APP-1
Three areas related to human orientation control are investigated: (1) reflexes associated with the control of eye movements and posture; (2) the perception of body rotation and position with respect to gravity; and (3) the strategies used to resolve sensory conflict situations which arise when different sensory systems provide orientation cues which are not consistent with one another or with previous experience. Of particular interest is the possibility that a subject may be able to ignore an inaccurate sensory modality in favor of one or more other sensory modalities which do provide accurate orientation reference information. This process is referred as sensory selection. This proposal will attempt to quantify subject's sensory selection abilities and determine if this ability confers some immunity to the development of motion sickness symptoms.

Mars crews will undergo prolonged periods of isolation and confinement, travel unprecedented distances from earth and be subjected to formidable combinations of hardships and dangers. Some of the biomedical, psychological and social challenges of the first manned Mars expedition are reviewed and means of aligning humans, technology and space habitats in the interests of mission success are identified.
AEROSPACE MEDICINE
AND BIOLOGY
A Continuing Bibliography (Suppl. 350)

JUNE 1991

51
LIFE SCIENCES (GENERAL)

A91-24780* Florida State Univ., Tallahassee.
MICROFILAMENTS DURING SEA URCHIN FERTILIZATION - FLUORESCENCE DETECTION WITH RHODAMINYL PHALLOIDIN
C. A. CLINE and GERALD SCHATTEN (Florida State University, Tallahassee) Gamete Research (ISSN 0148-7280), vol. 14, 1986, p. 277-291. Research supported by NIH and NSF. refs (Contract NAG2-340) Copyright

A91-24781* Florida State Univ., Tallahassee.
MOTILITY AND CENTROSOMAL ORGANIZATION DURING SEA URCHIN AND MOUSE FERTILIZATION
HEIDE SCHATTEN and GERALD SCHATTEN (Florida State University, Tallahassee) Cell Motility and the Cytoskeleton (ISSN 0271-6585), vol. 6, 1986, p. 163-175. refs (Contract NAG2-340; NIH-HD-12913; NSF PCM-83-15900) Copyright

It is noted that microfilaments are essential for incorporation of sperm in sea urchins and for pronuclear apposition in mice. The ability of sea urchin sperm to fertilize eggs is lowered by latrunculin, giving evidence that acrosomal microfilaments are of importance to the process of fertilization. Due to the uncertainty regarding the presence of microfilaments in various mammalian sperm, it is interesting that latrunculin does not noticeably affect the ability of mouse sperm to fertilize oocytes. The movements of the sperm and egg nuclei at the time of sea urchin fertilization are dependent on microtubules arranged into a radial monastral array (the sperm aster). In the mouse egg, microtubule activity is also required during pronuclear apposition, but they are arranged by a number of egg cytoplasmic sites. Results of the investigations show that both microtubules and microfilaments are necessary for the successful completion of fertilization in both mice and sea urchins, but at different stages. Also, it is demonstrated that centrosomes are contributed by the sperm in the process of sea urchin fertilization, but in mammals they may be inherited maternally.

A91-24784* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
BIOCONVETIVE PATTERNS, SYNCHRONY, AND SURVIVAL

With and without bioconvective pattern formation, a theoretical model predicts growth in light-limited cultures of motile algae. At the critical density for pattern formation, the resulting doubly exponential population curves show an inflection. Such growth corresponds quantitatively to experiments in mechanically unstirred cultures. This attatches survival value to synchronized pattern formation.

A91-25297
POTENTIAL OF THE REDOX STATE OF THE RABBIT BRAIN CORTEX UNDER HYPNOSIS (IMMOBILIZATION STRESS)
[POWENTSYAL OKISITEL’NO-YOCTANOVITEL’NOGO SOSTOIANIIA KORY GOLOVNOGO MOZGA KROLIKA VO VREMIA GIPNOZA /IMMOBILIZATSIONNOGO STRESSA/]

A91-25329#
EFFECTS OF COLD, NOISE AND WHOLE BODY VIBRATION STRESS ON NEUROTRANSMITTERS IN THE RAT BRAIN
HIROYUKI NAKAMURA, SEIICHI NOHARA, HIDEKI NAKAMURA, HIROFUMI NAGASE (Kanazawa University, Japan), KOICHI TSUNASHIMA (Hospital for Mental, Nervous and Muscular Disorder, Kodaira, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, Sept. 1990, p. 57-66. In Japanese, with abstract in English. refs

Central nervous system reactions of organisms to cold, noise, and whole body vibration (WBV) stress are studied. The levels of dopamine (DA), homovanillic acid (HVA), and substance-P-like and neuropeptidinlike immunoreactivities (SP-LI, NT-LI) in frontal cortex (FC), nucleus accumbens (NAC), striatum (STR) and hypothalamus (HYP) of rats exposed to cold of 4 C, noise of 102 dB, or WBV of 4 G with duration 90 min are examined. The results indicate that mesofrontal and mesoaccumbens DA systems are activated by cold, noise, and WBV. Reactions in the HYP are assumed to be involved in the thermoregulation of the organisms.

A91-26538
LARGEST KNOWN MICROBIALITES DISCOVERED IN LAKE VAN, TURKEY

The discovery is reported of enormous towerlike microbialites from alkaline Lake Van in eastern Anatolia. Growth is by mats of coccoid cyanobacteria permineralizing in situ with aragonite and by inorganically precipitated calcite. Certain aspects of these microbialites resemble Proterozoic marine stromatolites.

A91-26800#
DAY-NIGHT VARIATION OF HEAT LOSS RESPONSE TO INTERNAL BODY HEATING IN FREELY MOVING RATS
OSAMU SHIDO and TETSUO NAGASAKA (Kanazawa University, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, March 1990, p. 9-15. refs (Contract MOESC-6187009; MOESC-62770114)

Copyright
C. CARTER (NASA, Marshall Space Flight Center, Huntsville, AL),
CRYSTALLIZATION OF THE FAB FROM A HUMAN
ELENA CASALE, XIAO-MIN HE, ROBERT S. SNYDER, DANIEL
IMMUNODEFICIENCY VIRUS TYPE I

(type I hair cells) are weakly inhibitory. The simulations also illustrate
network functions best when some of the detecting elements (i.e.,
system. On the basis of initial simulations, it is concluded that the
model system. L.K.S.

model, consisting of six tiers, is constructed to mimic the neural
network. A complex symbolic model is produced through use of
symbolically model information processing by the macular neural
interpreted on physical and engineering principles. Having

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A monoclonal IgG antibody directed against gp 41 from the
human immunodeficiency virus (HIV-1) has been crystallized in
both intact and Fab forms. Crystals of the intact antibody grow as
tetragonal-like prisms too small for conventional X-ray analysis.
However, the Fab portion of the antibody produces suitable plate-like
crystals which belong to the space group P2(1)2(1)2(1) with unit
cell constants of a = 66.5 Å, b = 74.3 Å, and c = 105.3 Å.
There is one molecule of Fab in the asymmetric unit. The Fab
crystals show diffraction to d-spacings less than 3.0 Å. Author

A91-27964* Wright State Univ., Dayton, OH.
HABITUATION OF MOTION SICKNESS IN THE CAT
GEORGE H. CRAMPTON and JAMES LUCOT (Wright State
University, Dayton, OH) Aviation, Space, and Environmental
refs
Copyright

Thirty female cats were subjected to a motion sickness stimulus
in three series of tests. A series consisted of five tests given
biweekly, weekly, or daily. Each test consisted of 30 min of
stimulation followed by 1 min of rest, and series were separated
by a period of not less than 14 d. Retching was the dependent
variable. No habituation (reduction in the incidence of retching)
was found with biweekly testing but pronounced habituation was
observed with weekly and daily testing. The 30 cats were divided
evenly into high and low susceptibility groups based on the results
of the biweekly tests. The rate of habituation was the same for
the two susceptibility groups in both the weekly and daily series.

A91-28156* National Aeronautics and Space Administration.
TOWARD MODELING A DYNAMIC BIOLOGICAL NETWORK
M. D. ROSS (NASA, Ames Research Center, Moffett Field, CA),
J. E. D. DAYHOFF (Judith Dayhoff and Associates, Mountain View,
CA), and D. H. MUGLER (Akron, University, OH) Mathematical
and Computer Modelling (ISSN 0895-7177), vol. 13, no. 7, 1990,
p. 97-105. refs
Copyright

The organization of a mammalian macular endorgan is
interpreted on physical and engineering principles. Having
accomplished this task, it is possible to mathematically and
symbolically model information processing by the macular neural
network. A complex symbolic model is produced through use of
mathematical notations that describe the functioning system. The
model, consisting of six tiers, is constructed to mimic the neural
system. On the basis of initial simulations, it is concluded that the
network functions best when some of the detecting elements (i.e.,
type I hair cells) are weakly inhibitory. The simulations also illustrate
the importance of disorientation of receptors located in the third
tier in shaping nerve discharge patterns at the sixth tier in the
model system.

A91-28158* National Aeronautics and Space Administration.
CRystallization OF THE Fab FrOm A HuMaN
Monoclonal Anti-HIV Type I

ECLENA CASALE, XIAO-MIN HE, ROBERT S. SNYDER, DANIEL
C. CARTER (NASA, Marshall Space Flight Center, Huntsville, AL),
ELISABETH WENISCH, ALOIS JUNGBAUER, CHRISTA TAUER,

FLORIAN RUKER (University of Agriculture and Forestry, Vienna,
Austria), and PIER GIORGIO RIGHETTI (Milano, Universita, Milan,
Italy) Journal of Molecular Biology (ISSN 0022-2836), vol. 216,
1990, p. 511, 512. Research supported by ASI, NASA, and
BMWFV. refs
Copyright

A monoclonal IgG antibody directed against gp 41 from the
human immunodeficiency virus (HIV-1) has been crystallized in
both intact and Fab forms. Crystals of the intact antibody grow as
tetragonal-like prisms too small for conventional X-ray analysis.
However, the Fab portion of the antibody produces suitable plate-like
crystals which belong to the space group P2(1)2(1)2(1) with unit

cell constants of a = 66.5 Å, b = 74.3 Å, and c = 105.3 Å.
There is one molecule of Fab in the asymmetric unit. The Fab
crystals show diffraction to d-spacings less than 3.0 Å. Author

A91-17529# Arizona State Univ., Tempe. Dept. of Physics.
MICROWAVE RESONANCES IN DNA
S. M. LINDSAY Aug. 1990 29 p Sponsored in part by Health
Effects Research Lab., Research Triangle Park, NC
(Contract EPA-86-02-4105)
(PB90-261520; EPA/600/1-90/007) Avail: NTIS HC/ MF A03

Spectroscopic studies are described of DNA which were
undertaken to better understand a physical basis for microwave
absorption by this molecule. Three types of studies are described.
The low frequency scattered light spectrum of DNA was studied by
two methods. First, Raman scattering of the vibrational modes of
DNA films was studied down to about 4 wavenumbers/cm using
a high contrast grating monochromator. The lowest lying vibrational
mode was found at frequencies between 12 and 30/cm, depending
upon the specific water content, counter-ion, and crystal structure.
Second, a tandem interferometer was used to study the spectrum
from about 0.1 to 10/cm (3 to 300 GHz). Studies of Li-DNA films
and solutions of the plasmid pUC8 found no evidence of GHz
resonances in the scattered light spectrum or in the Brillouin
spectra. The primary hydration shell relaxes at about 40 ps at
room temperature and might permit resonances at frequencies
between 20 and 200 GHz. However, none were observed. Attempts
to repeat experiments that appeared to show a resonance mode
near 0.6 GHz were unsuccessful.

A91-17530# Corvallis Environmental Research Lab., OR.
Biodiversity and Human Impacts
J. R. BARKER, S. HENDERSON, R. F. NOSS, and D. T. TINGEY
Dec. 1990 40 p Prepared in cooperation with NSI Technology Services
Corp, Corvallis, OR
(PB90-263963; EPA/600/D-90/144) Avail: NTIS HC/MF A03

The basic issue that drives all concerns about biodiversity is
the accelerating and irreplaceable loss of genes, species,
populations, and ecosystem through environmental degradation
due to deforestation, strip mining and other developmental
projects. Associated with these losses are reduced options for
ecological and biological adaptation to an uncertain and ever changing
environment; possible disruption of essential ecological processes
and services; and loss of products obtained from nature (presently
or potentially). In addition, it is suggested that species, ecosystems,
and other elements of biodiversity are valuable in and of themselves
and thus should be protected and enhanced. Biodiversity values

can be categorized as human utilitarian; ecological utilitarian;
cultural, recreational, and esthetic; and ethical or intrinsic.

A91-17531# National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, TX.
A huge VeScULaR VeNsUlar aPParatus (VIVA) cONCrEtION
VOLUME RATIO Patent Application
DAVID A. WOLF, inventor (to NASA), CLARENCE F. SAMS,
inventor (to NASA), and RAY P. SCHWARZ, inventor (to NASA)
11 Dec. 1990 25 p
An improved bio-reactor vessel and system useful for carrying out mammalian cell growth in suspension in a culture media are presented. The main goal of the invention is to grow and maintain cells under a homogeneous distribution under acceptable biochemical environment of gas partial pressures and nutrient levels without introducing direct agitation mechanisms or associated disruptive mechanical forces. The culture chamber rotates to maintain an even distribution of cells in suspension and minimizes the length of gas diffusion path. The culture chamber design is presented and discussed. Y.S.

N91-17532# Trondheim Univ. (Norway). Dept. of Physics.

A SYSTEM ANALYTICAL AND EXPERIMENTAL STUDY OF GRAVITROPIC REACTIONS IN PLANTS Thesis
(ETN-91-98586) Avail: NTIS HC/MF A05

Plant movements, oscillative growth movements, and circulations are studied. The gravitropic response to gravitropic stimuli is described. Preliminary studies for an experiment to be performed in Spacelab are presented, where the response of Avena coleoptiles is investigated under weightlessness. The circulations of the Helianthus hypocotyl are dealt with. Experimental and theoretical investigations of these oscillative movements under different g levels are presented. The effects of Li(x) on circulations of sunflower hypocotyls are studied. The equipment used to compensate plant movements is described. Examples are given on the use of the equipment in studies of phototropic movements, circulations, and circadian leaf movements. ESA

N91-18568# Princeton Univ., NJ. Dept. of Physics.

DEVELOPMENT AND APPLICATION OF PHOTOSENSITIVE DEVICE SYSTEMS TO STUDIES OF BIOLOGICAL AND ORGANIC MATERIALS Progress Report No. 1, 1 Jan. - 31 Dec. 1990
SOL M. GRUNER and GEORGE T. REYNOLDS 12 Jul. 1990 22 p
(Contract DE-FG02-87ER-60522) Avail: NTIS HC/MF A03

This report discusses the following basic research accomplishments: new x-ray structure determination methods were developed and applied to biomembrane lipid phases; a novel mechanism for general anesthesia was proposed; the elastic properties of membranes were investigated, both theoretically and experimentally; the effects of high pressures on membranes were studied; neuron differentiation was used to probe mesophase structure; and novel lipid and surfactant systems are characterized. Also discussed are instrumentation accomplishments. DOE

N91-18569# Argonne National Lab., IL. Chemistry Div.

AN EXTENDED MODEL FOR ELECTRON SPIN POLARIZATION IN PHOTOSYNTHETIC BACTERIA
(Contract W-31-109-ENG-38) Avail: NTIS HC/MF A03

We have developed a general model for electron spin polarization which includes contributions from both CIDE (chemically induced dynamic electron polarization) and CRP (correlated radical polarization). In this paper, we apply this model to sequential electron transfer in photosynthetic bacteria. Our model calculates the density matrix for the P(sup +)(sup minus) radical pair and transfers the polarization as it develops to the P(sup +)(sup minus) radical pair. We illustrate several possible cases. One case is equivalent to CIDE; no interactions are included on the secondary radical pair, P(sup +)(sup minus). Another approximates CRPP by either increasing the transfer rate from P(sup +)(sup minus) to P(sup +)(sup minus) or restricting interactions to the secondary radical pair, P(sup +)(sup minus). Others allow interactions on both the primary and secondary radical pairs with various transfer rates. DOE

N91-18570# Brandeis Univ., Waltham, MA.

CARBON AND HYDROGEN METABOLISM OF GREEN ALGAE IN LIGHT AND DARK Progress Report 1990 5 p
(Contract DE-FG02-86ER-13486) (DE91-005642; DOE/ER-13486/5) Avail: NTIS HC/MF A01

The focus of this project was the elucidation of anaerobic metabolism in cyanobacterial green algae, Chlamydomonas reinhardii. Chlamydomonas is a versatile organism that can grow under disparate conditions such as fresh water lakes and sewage ponds. The cell photoassimilates CO2 aerobically and anaerobically, the latter after adaptation to a hydrogen metabolism. It can recall the ketogenic or oxynzymatic reaction and utilize hydrogen the simplest of all reducing agents for the dark assimilation of CO2 by the photosynthetic carbon reduction cycle. The dark reduction with hydrogen lies on the border line between autotrophic and heterotrophic carbon assimilation. Both autotrophic and heterotrophic bacteria are known in which molecular hydrogen can replace either inorganic or organic hydrogen donors. Here the dark reduction of CO2 acquires a particular importance since it occurs in the same cell that carries on photoreduction and photosynthesis. It is demonstrated that the algae chloroplast possesses a respiratory capacity. It seems likely that Chlamydomonas may have retained the chloroplastic respiratory pathway because of the selective advantage provided to the algae under a wide range of environmental conditions that the cells experience in nature. The ability to cycle electrons and poised the reduction level of the photosynthetic apparatus under aerobic and anaerobic conditions could allow more efficient CO2 fixation and enhanced growth under unfavorable conditions or survival under more severe conditions. DOE

N91-18571# Clemson Univ., SC. Dept of Biological Sciences.

THE MAGNESIUM CHELATION STEP IN CHLOROPHYLL BIOSYNTHESIS
JON WEINSTEIN Nov. 1990 8 p
(Contract DE-FG09-89ER-13989; DE-FG09-87ER-13768) (DE91-006619; DOE/ER-13989/2) Avail: NTIS HC/MF A02

In photosynthetic organisms, the biogenesis of energy transducing membranes requires the coordinate synthesis of photosynthetic groups, proteins, and various lipids. Two of the major prosthetic groups, chlorophyll and heme, share a common biosynthetic pathway that diverges at the point of metal insertion into protoporphyrin IX (Proto). Insertion of iron leads to the formation of hemes, while insertion of magnesium is the first step unique to chlorophyll formation. This project is directed toward identifying the enzyme(s) responsible for magnesium chelation and elucidating the mechanism which regulates the flux of precursors through the branch point enzymes in isolated chloroplasts.

Using intact chloroplasts from greening cucumber cotyledons, the ATP requirement for Mg-Proto formation was confirmed. Use of non-hydrolyzable ATP analogs, uncouplers and ionophores has led to the conclusions that ATP hydrolysis is necessary, but that this hydrolysis is not linked to the requirement for membrane intactness by transmembrane ion gradients or electrical potentials. The enzyme(s) are flexible with respect to the porphyrin substrate specificity, accepting porphyrins with -vinyl, -ethyl, or -H substituents at the 2 and 4 positions. The activity increases approximately four-fold during greening. Possible physiological feedback inhibitors such as heme, protochlorophyllide, and chlorophyllide had no specific effect on the activity. The activity has now been assayed in barely, corn and peas, with the system from peas almost ten-fold more active than the cucumber system. Work is continuing in pea chloroplasts with the development of a continuous assay and investigation of the feasibility of characterizing an active, organelle-free preparation. DOE
and 73 percent auditory asymmetry). It was also found that pilots in
with respect to the lower limb, 75 percent with respect to vision,
organisms (91 percent with respect to the upper limb and 55 percent
found that most pilots exhibited right-side asymmetry of the paired
efficiency of the upper and lower limbs, eyes, and ears was
V. A. BODROV, T. A. DOBROKHOTOVA, and A. G. FEDORUK
In Russian, refs
PROFESSIONAL EFFICIENCY OF PILOTS
FUNCTIONAL ASYMMETRY OF PAIRED ORGANS AND THE
Physiological stress reactions in a parachute jumper occurring
before and during the parachute jump are discussed together with
the danger associated with landing and the specific types of injuries
most commonly occurring during the parachute opening and/or
landing. It is pointed out that repeated exposures to impact trauma
during the parachute opening and landing might cause permanent
degenerative-distrophic changes in the spinal column. Measures
for the prevention of neurologic disorders in parachute jumpers are
discussed.

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

MEDICAL SUPPORT OF PARACHUTE JUMPS [SPETSIIFIKAI
MEDITISINSKOGO OSBEZHENIIA PARASHUTNYKH
PRYZHKOV]
V. S. VIDENIN, M. M. ODINAK, A. Iu. EMEL'IANOV, V. A.
GORISLAEVTS, and V. L. BARABASH Voennno-Meditsinskii
Zhurnal (ISSN 0026-9050), Nov. 1990, p. 52, 53. In Russian.
Copyright
Physiological stress reactions in a parachute jumper occurring
before and during the parachute jump are discussed together with
the danger associated with landing and the specific types of injuries
most commonly occurring during the parachute opening and/or
landing. It is pointed out that repeated exposures to impact trauma
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FUNCTIONAL ASYMMETRY OF PAIRED ORGANS AND THE
PROFESSIONAL EFFICIENCY OF PILOTS
V. A. BODROV, T. A. DOBROKHOTOVA, and A. G. FEDORUK
(AK SSSR, Institut Psikhologii, Moscow, USSR) Fiziologiya
In Russian. ref
Copyright
Data are presented from a study in which the functional
efficiency of the upper and lower limbs, eyes, and ears was
correlated with the professional efficiency of 749 pilots. It was
found that most pilots exhibited right-side asymmetry of the paired
organs (91 percent with respect to the upper limb and 55 percent
with respect to the lower limb, 75 percent with respect to vision,
and 73 percent auditory asymmetry). It was also found that pilots in
the highest qualification group had the most prominently expressed
right-side asymmetry, especially with respect to auditory organs, due
most likely to an increase of this asymmetry during their
professional life. Among pilots characterized by low reliability, the
majority exhibited a mixed type of asymmetry (i.e., some organs
had left-sided asymmetry or were functionally symmetric).

THERMAL-NEUTRALITY ZONE IN THE HUMAN BODY UNDER
THermal ADAPTAtion (ZONA THERMAL'NOSTI CHELOVEKA PRI
TEPLOVOI ADAPTATSII)
M. D. KHUDAIBERDIEV and F. F. SULYANTOV (AN TSSP, Institut
Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad,
Turkmen SSR) Akademiya Nauk SSSR, Doklady (ISSN 0002-3264),
vol. 315, no. 4, 1990, p. 1011-1014. In Russian. ref
Copyright
The boundaries of the temperature-neutrality zone in the human
body under seasonal adaptation were investigated in 16 subjects.
Experimental results indicate that seasonal adaptation in humans
is accompanied by a narrowing of the thermal-neutrality zone.

RELATION BETWEEN CARDIOVASCULAR RESPONSES AND
BODY TILTING ANGLES
MASAMICHI SUDO, KENJI KAWAKAMI, KUNINOBU YOKOTA,
MASATOSHI SHIOTA, SACHIO IKAWA (Jikei University, Tokyo,
Japan) et al. Japanese Journal of Aerospace and Environmental
Medicine (ISSN 0387-0723), vol. 27, Sept. 1990, p. 75-83. In
Japanese, with abstract in English. ref
Copyright
Experimental studies on the relationships between cardiovascular
response and body tilting angles are presented. Twenty-eight healthy males are examined at the positions of 10,
30, 45, 70, and 90 deg head up and 10, 30, and 45 deg head
down. Stroke volume (SV), cardiac output (CO), heart rate (HR),
and transthoracic impedance (Zt) are recorded and processed
using a personal computer; systolic blood pressure (SBP) and
diastolic blood pressure (DBP) are measured by an automatic digital
sphygmomanometer every minute. Mean arterial pressure (MAP)
and pulse pressure (PP) from SBP, and total peripheral resistance
(TPR) from MAP and CO are calculated. The results are presented in
graphs and extensive tables and characterized in detail. It is
found that head-up tilt produces increases in DBP, HR, MAP, and
TPR, decreases in PP, SV, and CO; but no change in SBE

CHANGES IN UPPER AIRWAY RESISTANCE DURING
PROGRESSIVE NORMOCAPNIC HYPOXIA IN NORMAL MEN
F. MALTAIS, L. DING, Y. CORMIER, and F. SERIES (Hopital Laval;
Universite Laval, Sainte Foy, Canada) Journal of Applied
Research supported by the National Center of Excellence of
Canada. ref
Copyright
The effect of progressive normocapnic hypoxia on the nasal
and pharyngeal resistance was investigated in nine human subjects
in which progressive increase of this asymmetry during their
professional life. Among pilots characterized by low reliability, the
majority exhibited a mixed type of asymmetry (i.e., some organs
had left-sided asymmetry or were functionally symmetric).
I.S.
A91-26556
EVIDENCE FOR HYPOXIC DEPRESSION OF CO2-VENTILATION RESPONSE IN CAROTID BODY-RESECTED HUMANS
YOSHIYUKI HONDA and IKKO HASHIZUME (Chiba University, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 590-593. refs
Copyright

The effect of a carotid-body resection in humans on the CO2-ventilation response was investigated by comparing the steady-state CO2-ventilation response curves with hyperoxia and mild hypoxia in five carotid-body-resected (BR) patients with those of control patients. It was found that, compared with control patients, the hypoxic CO2-ventilation response in BR patients was significantly depressed. It is suggested that the depression resulted, at least in part, from a modulation of the brain-stem neural mechanism due to the loss of afferent discharges from the carotid body. I.S.

A91-26557
CLASSICAL CONDITIONING OF VENTILATORY RESPONSES IN HUMANS
JORGE GALLEGO and PIERRE PERRUCHET (Paris VI, Universite, France) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 676-682. Research supported by the Institut National de la Santé et de la Recherche Medicales. refs
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The effect of classical conditioning on the ventilatory responses in humans was examined in subjects, assigned either to an experimental or a control group, in whom an auditory and hypoxic stimulus were either paired or not paired, respectively. The results on the patterns of breathing obtained in two groups of subjects provide evidence that an auditory stimulus that was paired repeatedly with a hypoxic stimulus may acquire the ability to elicit a ventilatory response due, specifically, to pairing. It is suggested that conditioned vegetative responses may considerably enhance the adaptability of organisms to varying environmental conditions. I.S.

A91-26558
ATTENUATED CAROTID BODY HYPOXIC SENSITIVITY AFTER PROLONGED HYPOXIC EXPOSURE
KOICHIRO TATSUMI, CHERYL K. PICKETT, and JOHN V. WEIL (Colorado, University, Denver; Chiba University, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 746-755. refs
(Contract NIH-HL-14985)
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The relative importance of the central and the peripheral mechanisms in the decreased hypoxic ventilatory response (HVR) that accompanies prolonged exposure to hypoxia was investigated in cats exposed to simulated altitude of 5500 m for 3-4 weeks. The ventilatory responses to hypoxia were measured in each cat before and after the exposure, while the carotid sinus nerve (CSN) responses (which had to be measured by an invasive technique) before and after the exposure, while the carotid sinus nerve (CSN) response. It was found that, compared with control patients, the hypoxic CO2-ventilation response in BR patients was significantly depressed. It is suggested that the depression resulted, at least in part, from a modulation of the brain-stem neural mechanism due to the loss of afferent discharges from the carotid body. I.S.

A91-26559
AIR TRAVEL ACROSS FOUR TIME ZONES IN COLLEGE SWIMMERS
PATRICK J. O'CONNOR, WILLIAM P. MORGAN, KELLI F. KOLTYN, JOHN S. RAGLIN, JOEL G. TURNER (Arizona State University, Tempe; Wisconsin, University, Madison; W.S. Middleton Memorial Veterans Administration; Indiana University, Bloomington) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 756-763. Research supported by the U.S. Olympic Committee. refs
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The effect of air travel across several time zones on the athletic performance and the physiological parameters of trained athletes was investigated in 18 female and 22 male college swimmers flown across four time zones in the east-to-west (E-W) direction and, three weeks later, in the west-to-east (W-E) direction. Results of two-way repeated-measured analyses of variance showed that, in comparison to preflight values, the pre- and postexercise cortisol levels decreased after the E-W travel and increased after the W-E travel. The resting and exercise heart-rate responses to air travel were small in magnitude, with their significance dependent on the direction of travel. However, the effort sense was not altered by air travel, and there were significant improvements in terms of the mood and the reduction in muscle soreness after both the E-W and the W-E travel. Responses of male and female subjects to air travel were similar. I.S.

A91-26560
ALVEOLAR GAS COMPOSITION AND EXCHANGE DURING DEEP BREATH-HOLD DIVING AND DRY BREATH HOLDS IN ELITE DIVERS
GUIDO FERRETTI, MARIO COSTA, MASSIMO FERRIGNO, BRUNO GRASSI, CLAUDIO MARCONI (Geneve, Universite, Geneva, Switzerland; CNR, Istituto di Tecnologie Biomediche Avanzate, Milan, Italy; New York, State University, Buffalo) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 794-802. Research supported by CNR, Istituto Iperbarico, and Circolo del Giardino of Italy. refs
(Contract NOAA-NA-81AADM0027)
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The circulatory changes and the alveolar gas composition and exchange, as well as the energetics of deep diving were investigated in three elite divers (EDs) and in control subjects by measuring the end-tidal O2 and CO2 pressures, expired volume, blood lactate concentration, and arterial blood O2 saturation (dry breath holds, BHs, only). It was found that the EDs were able to cope better than subjects with no diving experience with extreme BH diving depths and duration by means of a series of adaptations. It is suggested that an effective diving response consisting of peripheral (muscle) vasoconstriction reflex occurs in EDs during deep dives, as evidenced by the observed shift from aerobic to anaerobic metabolism. Additional features of adaptation, observed in EDs but not in control subjects, were blunted ventilatory responses to hypoxia and/or hypercapnia. I.S.

A91-26797
CIRCADIAN RHYTHM, SLEEP, AND FATIGUE IN AIRCREWS OPERATING ON LONG-HAUL ROUTES
ALEXANDER SAMEL and HANS-MARTIN WEGMANN IN: Aviation psychology, Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 404-422. refs
Copyright

Aircrews operating on world-wide routes have to cope with rapid time-zone transitions, when flying transmeridian sections, and with duty periods of varying duration, which may commence at any time of the day or the night. These conditions lead to irregularities of sleep (Nicholson, 1972) and to a disparity between internal body time and the external time of the environment (Klein and Wegmann, 1980). The interference of the irregular pattern of flight duty with the natural sleep-wake cycle and with the circadian system affects physiological as well as mental and behavioral functions. Sleep is often disturbed because it is attempted during an inappropriate phase of the circadian system, or at periods when the local environmental conditions are disadvantageous. Disturbances of circadian rhythm are caused by desynchronization from the new local time. Both sources of interference, i.e., shifted work and shifted time, may have implications for optimal safety and efficiency in air carrier operations. Author
ALTERATION OF CIRCADIAN RHYTHM OF PLASMA CORTISOL AFTER EASTWARD FLIGHT AND THE EFFECT OF LIGHT EXPOSURE
NAOKO TAJIMA, AKIRA SASAKI, HIROFUMI OHKOSHI, MIKIO UEMATSU, ICHIRO ASUKATA (Japan Airlines, Flight Crew Medical Service Dept., Tokyo, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, June 1990, p. 35-41. refs
The study aims to clarify the effect of time zone flight on circadian rhythm of plasma cortisol and to investigate the influence of light exposure on the resynchronization. Twelve healthy male volunteers aged 20-26 years underwent an eastward 8 h time shift by jet from Tokyo to San Francisco and spent strictly scheduled 10 days. Control group (n = 6), who lived under the natural sun light condition with more than 10,000 lux for 3 hours in the morning for days two to four showed a recovery of the circadian rhythm of plasma cortisol by day seven. However, the artificial light group (n = 3), who were exposed to 3000 lux fluorescent lamp in a room, and the dim light group (n = 3), who wore eye masks during the same time frame, did not show resynchronization within 10 days. The results indicate that the bright light exposure seems to have some effects on the faster resynchronization of plasma cortisol. Author

IMPLICATIONS OF THE NEW RADIATION EXPOSURE LIMITS ON SPACE STATION FREEDOM CREWS
M. STANFORD (McDonnell Douglas Space Systems Co., Space Station Div., Houston, TX) and D. S. NACHTWEY (NASA, Johnson Space Center, Houston, TX) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1326-1333. refs
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Levels of acceptable risk of radiation exposure for SSF crews have been studied. Since the cancer risk per dose equivalent has increased over the last decade, new dose-equivalent limits have been recommended. An astronaut may not receive more than a depth-dose equivalent of 50 rem/year. It is found that a 180-day mission in a nominally shielded spacecraft in a constant atmospheric density orbit with a varying altitude could result in a depth-dose equivalent of 10 rem. This is twice the annual allowable dose-equivalent for terrestrial radiation workers. It is noted that the present understanding of the biological effectiveness of high-LET radiation is not adequate for accurate health risk assessments and that further research is necessary. O.G.

PREDICTION OF SPACE MOTION SICKNESS SUSCEPTIBILITY BY DISCONJUGATE EYE TORSION IN PARABOLIC FLIGHT
SHIRLEY G. DIAMOND and CHARLES H. MARKHAM (California University, Los Angeles) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 201-205. refs
Copyright
The hypothesis of asymmetric otolith function asserts that physiological or anatomical differences in the two sides of the bilateral gravity-sensing otolith apparatus of the inner ear may be well compensated on earth, but when exposed to novel gravitational states, the prior compensatory stratagems may be ineffective, leading to unstable vestibular responses and causing the phenomenon of space motion sickness. To investigate this hypothesis, spontaneous eye torsion, a reflex governed by the otolith organs, was examined in the upright position during the hypogravity of parabolic flight aboard NASA's KC-135 aircraft in nine former astronauts whose history of space motion sickness was revealed after data analysis had been completed. Results showed that astronauts who had been sick in space had significantly higher scores of disconjugate eye torsion in parabolic flight, and that their responses were consistently different in 1.8 G relative to 0 G compared to astronauts who had not been sick in space. In 1 G, there was no difference in disconjugate eye torsion between the subjects. The results support the asymmetry hypothesis and offer a possible predictive test of space motion sickness. Author

DECREASED SUSCEPTIBILITY TO MOTION SICKNESS DURING EXPOSURE TO VISUAL INVERSION IN MICROGRAVITY
JAMES R. LACKNER and PAUL DIZIO (Brandeis University, Waltham, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 206-211. refs (Contract NAG9-295)
Copyright
Head and body movements made in microgravity tend to bring on symptoms of motion sickness. Such head movements, relative to comparable ones made on earth, are accompanied by unusual combinations of semicircular canal and otolith activity owing to the unloading of the otoliths in 0G. Head movements also bring on symptoms of motion sickness during exposure to visual inversion (or reversal) on earth because the vestibulo-ocular reflex is rendered anti-compensatory. Here, evidence is presented that susceptibility to motion sickness during exposure to visual inversion is decreased in a 0G relative to 1G force background. This difference in susceptibility appears related to the alteration in otolith function in 0G. Some implications of this finding for the etiology of space motion sickness are described. Author

MARIJUANA CARRY-OVER EFFECTS ON AIRCRAFT PILOT PERFORMANCE
VON O. LEIREN (Decision Systems, Stanford, CA), JEROME A. YESAVAGE, and DANIEL G. MORROW (Stanford University, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 221-227. refs (Contract NIH-DA-03593; NIH-2-R44-AG-06957-02)
Copyright
This study finds evidence for 24-h carry-over effects of a moderate social dose of marijuana on a piloting task. In separate sessions, nine currently active pilots smoked one cigarette containing 20 mg of delta 9 THC and one Placebo cigarette. Using an aircraft simulator, pilots flew just before smoking, and 0.25, 4, 8, 24, and 48 h after smoking. Marijuana impaired performance at 0.25, 4, 8, 24, and 24 h after smoking. While seven of the nine pilots showed some degree of impairment at 24 h after smoking, only one reported any awareness of the drug's effects. The results suggest that very complex human/machine performance can be impaired as long as 24 h after smoking a moderate social dose of marijuana, and that the user may be unaware of the drug's influence. Author

EFFECT OF HYPOXIA ON PSYCHOMOTOR PERFORMANCE DURING GRADED EXERCISE
DOUGLAS R. KNIGHT, CHRISTINE SCHLICHTING, JAMES H. DOUGHERTY, ARTHUR A. MESSIER (U.S. Navy, Naval Submarine Medical Research Laboratory, Groton, CT), and DONALD V. TAPPAN (Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 228-232. Navy-supported research. refs
Copyright
The combined effects of reduced O2 (12 percent) and graded ergometer exercise (10, 70, and 140 W) on the performance of a psychomotor task are studied. Six men participated in two test sessions each. Each session began with the baseline data (air) and was followed with exposure data (12 or 21 percent, random, unidentified). The psychomotor task score was degraded during the 140-W work rate in the 12-percent O2 condition (p less than 0.05). Reductions of the Sa(O2) (p less than 0.05) at each work
rate proved that hypoxia existed during exercise in the 12-percent O2 condition. Author


Ethyl alcohol’s known ability to produce reliable decrements in pilot performance was used in a study designed to evaluate objective methods for assessing pilot performance. Four air carrier pilot volunteers were studied during eight simulated flights in a B727 simulator. Total errors increased linearly and significantly with increasing blood alcohol. Planning and performance errors, procedural errors and failures of vigilance each increased significantly in one or more pilots and in the group as a whole. Author

A91-27968 RELATIONSHIPS OF ANXIETY SCORES TO SCREENING AND TRAINING STATUS OF AIR TRAFFIC CONTROLLERS WILLIAM E. COLLINS, DAVID J. SCHROEDER, and LENDELL G. NYE (FAA, Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 236-240. refs Copyright

The present study assessed the relationship between anxiety, as measured by the state-trait personality inventory (STPI), and success of post-strike air traffic control specialist (ATCS) trainees at the FAA Academy and during field training. Results support the operation of some personality-related self-selection among ATCS applicants regarding anxiety and the importance of the low anxiety characteristic for ATCS job success. Author

A91-27969 EFFECTS OF WATER TEMPERATURE ON PERFORMANCE - A PRACTICAL EVALUATION OF A NEUTRAL BUOYANCY FACILITY GRETA BOLSTAD, EIRIK MYRSETH, BARD HOLAND, and ARVID PASCHE (Foundation for Scientific and Industrial Research, Trondheim, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 241-245. ESA-supported research. refs Copyright

Manual and cognitive performance of two female and four male divers was evaluated in "cold" and "warm" water in a neutral buoyancy facility. A test battery of six manual and cognitive tests was applied in a fixed sequence in three separate, 3-h dives: (1) water temperature 18-19 C, wet suit 3.5-mm thick, (2) water temperature 32-33 C, bathing suit and T-shirt, and (3) water temperature 18-19 C, tailor made wet suit 6.5-mm thick. No significant differences in performance between the three conditions were recorded. Mean rectal temperature decreased by 1 C in all dive conditions, except in females in dive 2. Ventilation was significantly higher in dive 1 than in dives 2 and 3. Thermal discomfort was reported only after 2 h in dive 1. It is suggested that support divers may work safely, comfortably, and effectively for at least 2 h in water of 18-19 C, if dressed in thermal protective wet suits. Author


To explore the mechanism for facial puffiness, headache, and nasal congestion associated with microgravity and cephalad fluid shifts, the postural responses of the cutaneous microcirculation (CMC) in the forehead and dorsum of the foot of eight healthy men were studied by changing body position on a tilt table and measuring blood flows with a laser Doppler flowmeter. Increasing arterial pressure in the feet by moving from a -6-deg head-down tilt to a 60-deg head-up posture decreased foot CMC by 46.5 + or - 12.0 percent. Raising arterial pressure in the head increased forehead CMC by 25.5 + or - 0.7 percent (p less than 0.05). To investigate the possibility that these opposite responses could be modified by simulated microgravity, tilt test were repeated after 7 d of -6-deg head-down-tilt bed rest. The responses were not significantly different from those recorded before bed rest. Therefore, CMC in the feet is well regulated to prevent edema when shifting to an upright position, whereas there is less regulation in the head CMC. Author

A91-27971 STEADY STATE AND TRANSIENT G-EXCESS EFFECTS FRED E. GUIDRY and ANGUS H. RUPERT (U.S. Navy, Naval Aerospace Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 252, 253. refs Copyright

Acceleration forces of flight are associated with a number of spatial orientation illusory effects. This note focuses on two effects, both called the 'G-excess effect'. A distinction between steady-state and transient G-excess effects is important because prescriptions for preventive management of effects in flight will differ. Author

A91-27972 REDUCED CONTRAST SENSITIVITY WHEN VIEWING THROUGH AN AIRCRAFT WINDSCREEN PHILIP K. HUGHES (Department of Defence, Aeronautical Research Laboratory, Melbourne, Australia) and ALGIS J. VINGRYS (Melbourne, University, Parkville, Australia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 254-257. refs Copyright

The contrast sensitivity function (CSF) of an experienced observer was measured under normal viewing conditions, when looking through an aircraft windscreen and when looking through the windscreen in the presence of a glare source. It is found that contrast sensitivity was significantly reduced for frequencies above about 6 cycles/degree viewed through the windscreen and that the addition of a glare source further reduced contrast sensitivity for all spatial frequencies greater than 1 cycle/degree. These results demonstrate that the CSF is a sensitive metric of degraded visual performance when viewing through optical transparencies. Author

A91-27974 ERRORS IN MEASUREMENT OF +GZ ACCELERATION TOLERANCE DAVID A. LUDWIG (North Carolina, University, Greensboro) and LARRY P. KROCK (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 261-265. USAF-supported research. refs Copyright

Most acceleration studies estimate a subject’s G-level tolerance by taking only one determination (test) for a given condition. The purpose of this study was to examine the error structure and reliability of an individual’s acceleration tolerance and to provide design considerations for future experimentation. A hierarchical (nested) design was used to estimate the sources of variation in measuring G-level tolerance. Six males rode relaxed in the USAF School of Aerospace Medicine human-use centrifuge and were exposed to a 0.1 G/s onset rate profile until greyout. Each subject
was tested on three randomly selected days with three repeated determinations within a day. This design allowed for an estimate of both day-to-day and measurement error within a testing session. A single +Gz tolerance determination was found to be moderately unreliable (reliability coefficient = 0.74). Under the best of circumstances a subject's G-level tolerance cannot be estimated with any more accuracy than about +0.3 G with 95 percent confidence. This degree of accuracy can only be obtained with multiple measurements. 

A91-27975
THE USE OF THE PRESSURE CUFF TEST IN THE DIAGNOSIS OF DECOMPRESSION SICKNESS
FREDERICK W. RUDGE and JEFFREY A. STONE (USAFA, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0006-8993), vol. 499, 1989, p. 153-156. Research supported by USVA and Evenor Armingston Fund. refs

Copyright
Records at the Hyperbaric Medicine Division, United States Air Force School of Aerospace Medicine, were reviewed to determine the utility of the pressure cuff test as an aid in the diagnosis of Type I decompression sickness (DCS). Applying local pressure with a blood pressure cuff has been described as a useful test to differentiate the pain of DCS from that of other musculoskeletal conditions. Records were reviewed from January 1985 to December 1989. During this period 179 patients were treated with recompression for extremity pain. Application of a blood pressure cuff to the painful area was used as a diagnostic aid in 87 patients. Only 53 patients (61 percent) with DCS had a positive test (relief of pain with local pressure). Results did not correlate with the rapidity of relief of symptoms during recompression. It is concluded that the failure to respond to the application of local pressure should not be used to rule out the presence of DCS - this must be done with a test of pressure in a hyperbaric chamber. 

A91-28163* Toronto Univ. (Ontario).
COMPARISON OF SMOOTH PURSUIT AND COMBINED EYE-HEAD TRACKING IN HUMAN SUBJECTS WITH DEFICIENT LABYRINTHINE FUNCTION
R. J. LEIGH, S. E. THURSTON (Cleveland, University Hospitals; USVA, Medical Center, OH), J. A. SHARPE, P. J. RANALLI (Toronto Western Hospital, Canada), and M. A. HAMID (Cleveland Clinic Foundation, OH) Experimental Brain Research (ISSN 0014-4819), vol. 66, 1987, p. 458-464. Research supported by USVA, Evenor Armingston Fund, Toronto Western Hospital, and Medical Research Council of Canada. refs

Copyright
The effects of deficient labyrinthine function on smooth visual tracking with the eyes and head were investigated, using ten patients with bilateral peripheral vestibular disease and ten normal controls. Active, combined eye-head tracking (EHT) was significantly better in patients than smooth pursuit with the eyes alone, whereas normal subjects pursued equally well in both cases. Compensatory eye movements during active head rotation in darkness were always less in patients than in normal subjects. These data were used to examine current hypotheses that postulate central cancellation of the vestibulo-ocular reflex (VOR) during EHT. A model that proposes summation of an integral smooth pursuit command and VOR/compensatory eye movements is consistent with the findings. Observation of passive EHT (visual fixation of a head-fixed target during en bloc rotation) appears to indicate that in this mode parametric gain changes contribute to modulation of the VOR. 

A91-28164* Akron Univ., OH.
FREQUENCY AND VELOCITY OF ROTATIONAL HEAD PERTURBATIONS DURING LOCOMOTION
G. E. GROSSMAN, R. J. LEIGH, D. J. LANSKA, S. E. THURSTON (Cleveland, University Hospitals; USVA, Medical Center, OH), and L. A. ABEL (Akron, University, OH) Experimental Brain Research (ISSN 0014-4819), vol. 70, 1988, p. 470-476. Research supported by USVA and Evenor Armingston Fund. refs

Copyright
The magnetic search coil technique was used to record horizontal (yaw) and vertical (pitch) head rotations of 20 normal subjects during subjects walking in place, running in place, vigorous voluntary horizontal head rotation, and vigorous voluntary vertical head rotation. Data are presented to show that (1) during locomotion, the head is stabilized in space incompletely but adequately so that the vestibuloocular reflex (VOR) is not saturated; (2) during vigorous, voluntary head rotations, the maximum head velocity exceeds the range where the VOR can stabilize gaze; and (3) the frequencies of head rotations that occur during locomotion greatly exceed frequencies conventionally used in the laboratory for testing the VOR. 

A91-28170* BEHAVIOR OF HUMAN HORIZONTAL VESTIBULO-OCULAR REFLEX IN RESPONSE TO HIGH-ACCELERATION STIMULI
E. F. MAAS, W. P. HUEBNER, S. H. SEIDMAN, and R. J. LEIGH (Cleveland, University Hospitals; USVA, Medical Center, OH) Brain Research (ISSN 0006-8993), vol. 499, 1989, p. 155-156. Research supported by USVA and Evenor Armingston Fund. refs

Copyright
The horizontal vestibulo-ocular reflex (VOR) during transient, high-acceleration (1900-7100 deg/sec-squared) head rotations was studied in four human subjects. Such stimuli perturbed the angle of gaze and caused illusory movement of a viewed target (oscillosia). The disturbance of gaze could be attributed to the latency of the VOR (which ranged from 6-15 ms) and inadequate compensatory eye movements (median VOR gain ranged from 0.61-0.83). 

N91-17533# Texas Univ. Health Science Center, Houston. School of Public Health.
HYPERBARIC OXYGENATION (HBO) CLINICAL TRIALS: A REVIEW M.S. Thesis
JAMES ROY KNOWLES May 1990 48 p Sponsored by AFIT, Wright-Patterson AFB, OH (AD-A227901; AFIT/CI/CIA-90-097) Avail: NTIS HC/MF A03 CSCL 06/5

Hyperbaric oxygenation (HBO) has been used as a medical intervention for the treatment or prophylaxis of numerous conditions in humans. There is an accumulation of pre-clinical and clinical data supporting its use in humans. It has been asserted that the clinical data are largely derived from anecdotal, uncontrolled observations. The call for reliable data from good clinical trials has sounded forth both from within and from outside the HBO community. A logical question is: What clinical trials have actually been done to assess the efficacy of HBO, how good were they, and what did they find. This thesis will present a review of HBO clinical trials which will help answer the above question. The review will identify HBO clinical trials in the general medical literature, assess their methodologic content, and list the reported efficacy of HBO in the various trials. Lastly, the review will briefly discuss its findings as they relate to future clinical research involving the use of HBO.

GRA
N91-17534# Naval Medical Research Inst., Bethesda, MD.
EFFECTS OF MULTIPLE COLD AIR EXPOSURES ON DELAYED MATCHING TO SAMPLE PERFORMANCE Interim Report
DAVID W. ARMSTRONG and JOHN R. THOMAS 2 Apr. 1990 19 p (AD-A228390; NMRI-90-87) Avail: NTIS HC/MF A03 CSCL 06/10

Acute exposure to moderate cold impairs delayed matching to sample (DMS) performance in both animal and man. The effect of multiple cold air (2.6 + or - 0.6 C) exposures on DMS performance was investigated. Twelve men performed the DMS task during a 45 min exposure to cold air on Day 1. Oxygen consumption (VO2) was measured concurrently. After completion
of Day 1, subjects were assigned to two groups. Group W performed the DMS task on Days 2 to 11 in warm air (22 C) during a 45 min period before being exposed to cold air on days 2 to 11. On Day 12, all subjects were exposed to cold air as on Day 1. VO2 was measured concurrently on Days 4 to 8. DMS performance was significantly impaired in all subjects during exposure to cold air on Day 1 when compared to baseline DMS performance. Performance on the DMS was significantly different between the groups on Day 12. Group W performance was not different on Day 12 compared to Day 1. VO2 was elevated in the cold but was not different between groups. VO2 was not different on Day 12 compared to Day 1. DMS is affected by acute exposure to cold air. Performance on the DMS task improves with repeated cold air exposure only when the DMS task is repeatedly performed in cold air.

GRA

N91-17535# Institute for Defense Analyses, Alexandria, VA.
COLIN P. HAMMON and STANLEY A. HOROWITZ Mar. 1990 39 p
(Contract MDA903-84-C-0031)
(AD-A228582; AD-E501304; IDA-P-2379; IDA/HQ-90-35201)
Avail: NTIS HC/MF A03 CSCL 05/9

This work addresses the development of quantitative relationships between how much aircrews fly and how well they perform important aspects of their missions. It is determined that additional flying enhances proficiency in two ways: through the short-run honing of skills and through the long-run development of mastery. Estimates of the strength of the links between flying experience and three measures of performance are developed. The measures are: bombing accuracy, the quality of landings aboard aircraft carriers, and kills in air combat maneuvering exercises. In general, it is found that while both short-run experience is important, career experience has a stronger relationship than recent experience to performance.

GRA

N91-17536# National Inst. of Standards and Technology, Gaithersburg, MD.
FED-X: THE NIST EXPRESS TRANSLATOR
STEPHEN NOWLAND CLARK Aug. 1990 16 p
(PB90-269507; NISTIR-4371) Avail: NTIS HC/MF A03 CSCL 06/9

The product data exchange specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. PDES includes an information model written in the Express language; other PDES-related information models are also written in Express. The National PDES Testbed and NIST has developed software to manipulate and translate Express models. The software consists of an in-memory working form and an associated Express language parser, FED-X. The design and capabilities of FED-X and the Express Working Form are discussed.

GRA

N91-17537# Pacific Northwest Lab., Richland, WA.
ELF (EXTREMELY-LOW-FREQUENCY) FIELD INTERACTIONS AT THE ANIMAL, TISSUE AND CELLULAR LEVELS
(DE91-004807; PNL-SA-18664; CONF-9010265-1) Avail: NTIS HC/MF A03 CSCL 06/9

A description is given of the fundamental physical properties of extremely-low-frequency (ELF) electromagnetic fields, and the mechanisms through which these fields interact with the human body at a macroscopic level. Biological responses to ELF fields at the tissue, cellular and molecular levels are summarized, including new evidence that ELF field exposure produces alterations in gene expression and the cytoplasmic concentrations of specific proteins.

DOE

N91-17538# Texas Univ., Galveston. Dept. of Otolaryngology, Physiology and Biophysics.
MANNING J. CORREIA and TABARACCI 30 Jun. 1989 8 p
(Contract NAG2-186)
(NASA-CR-187877; NASA-126:187877) Avail: NTIS HC/MF A02 CSCL 06/16

The general goal was to examine tilt sensitivity of horizontal and semicircular canal afferents. Computer programs were developed which controlled the short axis centrifuge at the Vestibular Research Facility, acquired action potentials and produced data reduction analyses including histograms and gain and phase calculations. A pre-amplifier was also developed for the acquisition of action potentials. The data were gathered that can be used to contribute toward the understanding of the tilt sensitivity of semicircular canal afferents in the unanesthetized gerbil preparation.

Author

N91-17539# Naval BioDynamics Lab., New Orleans, LA.
4 Sep. 1990 27 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD (AD-A229030; NBDL-90R005) Avail: NTIS HC/MF A03 CSCL 06/5

This report lists all research reports, special reports, monographs, technical memoranda, joint reports, research information bulletins, journal articles, and conference proceedings published by the Naval BioDynamics Laboratory between January 1980 and August 1990.

GRA

N91-17540# Dartmouth Coll., Hanover, NH. Dept. of Psychology.
(Contract AF-AFOSR-0437-89; AF PROJ. 2313)
(AD-A229111; AFOSR-90-1132TR) Avail: NTIS HC/MF A05 CSCL 06/5

The saccadic control system represents a good model system to study the selection of stimulus events according to their spatial location. The present work focuses on two factors known to influence saccade latency: the presence of a fixation stimulus and the nature of the saccade target. We report evidence which suggests that fixation point offsets facilitate pre-motor stages of saccade generation (Reuter-Lorenz et al., in press; Appendix I). This idea, in conjunction with electrophysiological data, suggested that fixation offset might also facilitate saccades to acoustic targets. Experiment 1 confirmed this suggestion (Fendrich, et al. (in preparation)). The facilitatory effects of redundant stimulation via the visual and auditory modalities is examined in Experiment 2 (Nozawa et al., 1990). The data suggest significant neural summation, which we attribute to bimodal convergence onto individual cells though to mediate saccadic command functions.

GRA

N91-17541# Texas Univ. Health Science Center, San Antonio. Dept. of Ophthalmology.

111
The risk of falling ill to infectious diseases grows significantly among people in biological isolation. This shows up in the activation of conditionally pathogenic component of human microbiome, the weakening of the colonization resistance barrier, and the weakening of the immune system. Intensive microbial exchange occurs between people occupying hermetically sealed

microgravity-compatible instrumentation, and by changes in the microbial population over the life of the station.
space. The molecular epidemiological features of changes in drug resistance to Escherichia isolated from the intestines of cosmonauts during space flight and from subjects participating in a 30-day simulation study were examined. Y.S.


N91-18580# Joint Publications Research Service, Arlington, VA. PHARMACOLOGICAL REGULATION OF PHYSIOLOGICAL FUNCTIONS IN SPACE MEDICINE V. S. SHASKHOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-5 26 Sep. 1990 Transl. into ENGLISH from Farmakologiya i Toksikologiya, Moscow (USSR), v. 53, no. 1, Jan.-Feb. 1990 p 5-10 Avail: NTIS HC/MF A04 Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: biochemistry, biotechnology, epidemiology, medicine, immunology, medicine, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, and virology.


A study was conducted on the relationship between vertical optokinetic nystagmus and motion sickness on healthy males under conditions of simulated weightlessness. The factors affecting the vestibular apparatus (primarily optokinetic receptors) and redistribution of body fluids in the cranial direction were examined.
52 AEROSPACE MEDICINE

in subjects who are susceptible to motion sickness. These findings confirmed the importance of hemodynamics in the pathogenesis of motion sickness, as well as the fact that studies on vertical optokinetic nystagmus, particularly of downward predominance, may be of prognostic value regarding susceptibility to motion sickness during space flight.

Author

N91-18599# Joint Publications Research Service, Arlington, VA. CIRCADIAN PATTERNS IN PLASMA LIPIDS, CARBOHYDRATES, AND SOME HORMONES OF HEALTHY PILOTS Abstract Only
Avail: NTIS HC/MF A04

A comparative analysis was conducted on the circadian patterns of plasma lipids, hormones, and blood sugar in healthy pilots and an age- and health-equivalent group of non-flight specialists. The results demonstrated that the mean daily lipid and hormone levels in the pilots exceeded the corresponding control levels, usually by a factor of one-fold or better. In the case of blood sugar the relationship was reversed, with the level in the control subjects exceeding the value in pilots. Differences between the two groups were also noted in acrophase values and amplitude parameters. The most pronounced differences in acrophase were noted for blood sugar, beta-lipoproteins, and cholesterol. In general, the shifts were interpreted to reflect pilot adaptability in the face of stress, with the conclusion that these biochemical values may be used in assessment of occupational fitness.

Author

N91-18590# Joint Publications Research Service, Arlington, VA. EXPERIMENTAL ASSESSMENT OF EFFECT OF HEAD POSITION ON CENTER OF GRAVITY OF HUMAN BODY IN EJECTION SEATS Abstract Only
Avail: NTIS HC/MF A04

Kinematic experiments were performed on 55 pilots to assess the effects of head inclination on the body’s center of gravity in ejection seats. The purpose was to obtain quantitative data relating trajectory of the ejection seats in relation to anthropometric characteristics, employing a dynamographic stand designed to measure such effects. A two-factor regression equation relating head inclination to change in the center of gravity was derived and used for graph construction.

Author

N91-18591# Joint Publications Research Service, Arlington, VA. ULTRASONIC ASSESSMENT OF HUMAN TIBIA DURING 370-DAY ANTIORTHOSTATIC HYPOKINESIA Abstract Only
Avail: NTIS HC/MF A04

Studies were conducted on ultrasonic assessment of the effects of simulated weightlessness and exercise therapy on human long bones. The subjects were maintained in an anorthostatic position. Exercise therapy was constant throughout the experiment for some subjects, and for other ones it was started at the beginning of the fifth month. Acoustic profiles for 120 kHz waves revealed considerable individual variations in average velocity, average velocity in the diaphyses, and decrement values in velocity along the distal half of tibia. One year after the experiment all values returned to baseline levels, and the resultant data confirmed the beneficial effects of exercise on human long bones in simulated weightlessness.

Author

N91-18592# Joint Publications Research Service, Arlington, VA. STRESS AND HUMAN CIRCULATION Abstract Only
Avail: NTIS HC/MF A04

A variety of research and diagnostic techniques, including EKG, Doppler echocardiography, Xe-133 labels, etc., were employed in an assessment of human cerebral and systemic circulation during stress. The results demonstrated that intense mental activity potentiated cerebral blood flow, particularly in the supramarginal convolution of the brain, as well as in the angular convolution and in the parietotemporal and occipital region of the left cerebral hemisphere. In most cases an increased flow was also detected in the upper frontal convolution, Broca’s convolution, and the superior temporal convolution. Prolonged bed rest was also observed to be a stressful situation predisposing to hypertension. The data were consistent with the view that maximum mental concentration was accompanied by a decrease in heart rate but that in the majority of cases changes in regional and systemic hemodynamics are predicated on the emotional component of any activity. Cerebral hemodynamics in situations of intense mental activity appear to be closely connected to processes directed at maintaining optimum mental function and seem to be adaptive in nature. In general, mental activity within the framework of time constraints evoked hemodynamic changes that were as pronounced as those induced by submaximal physical demands.

Author

Avail: NTIS HC/MF A02

Although the dosimetric model of the respiratory tract used in ICRP (International Commission on Radiological Protection) Publication 30 had not been shown to be seriously deficient for the purpose of calculating Annual Limits on Intake (ALIs) for workers, the availability of new information led the ICRP in 1984 to create a special Task Group to review the dosimetric model of the respiratory tract and, if justified, propose revisions or a new model. The Task Group directed its efforts toward improving the model used in Publication 30 rather than developing a completely new model. The objective was a model that would facilitate calculation of biologically meaningful doses; be consistent with morphological, physiological, and radiobiological characteristics of the respiratory tract; incorporate current knowledge; meet all radiation protection needs; be user friendly by not being unnecessarily sophisticated; be adaptable to development of computer software for calculation of relevant radiation doses from knowledge of a few readily measured exposure parameters; be equally useful for assessment purposes as for calculating ALIs; be applicable to all members of the world population; and consider the influence of smoking, air pollutants, and diseases of the inhalation, deposition, and clearance of radioactive particles from the respiratory tract. The model provides for calculation of a committed dose equivalent for each region, adjusted for the relative cancer sensitivity of that region, and for the summing of these to yield a committed dose equivalent for the entire respiratory tract.

DOE

N91-18595# New York Univ. Medical Center. ONCOGENIC ACTION OF IONIZING RADIATION
1990 38 p
(Contract DE-FG02-87ER-60539)
(DE91-005979; DOE/ER-60539/T4) Avail: NTIS HC/MF A03
An extensive experiment involving approximately 400 rats exposed to the neon ion beam at the Bevalac in Berkeley, CA and to electrons is nearing completion. The carcinogenicity of energetic electrons was determined for comparison with the neon ion results. As in past reports we will describe progress in three areas corresponding to the specific aims of the proposal: (1) carcinogenesis and DNA strand breaks in rat skin following exposure by the neon ions or electrons; (2) DNA strand breaks in the epidermis as a function of radiation penetration; (3) oncogene activation in radiation-induced rat skin cancers.

N91-18596# Massachusetts General Hospital, Boston.
NEW IMAGING SYSTEMS IN NUCLEAR MEDICINE
1990 10 p
(Contract DE-FG02-87ER-60519)
(DE91-004782; DOE/ER-60519/T2) Avail: NTIS HC/MF A02
Further progress has been made on improving the uniformity and stability of PCR-I, the single ring analog coded tomograph. This camera has been employed in a wide range of animal studies described below. Data from PCR-I have been used in various image processing procedures. These include motion pictures of dog heart, comparison of PET and MRI image in dog heart and rat brain and quantitation of tumor metabolism in the nude mouse using blood data from heart images. A SUN workstation with TAAC board has been used to produce gated three-dimensional images of the dog heart. The ANALYZE program from the Mayo Clinic has also been mounted on a SUN workstation for comparison of images and image processing.

N91-18597# Lawrence Livermore National Lab., CA. Center for Accelerator Mass Spectrometry.
NEW BIOMEDICAL APPLICATIONS OF RADIOCARBON
(Contract W-7405-ENG-48)
(DE91-006249; UCRL-JC-105825; CONF-9006309-1) Avail: NTIS HC/MF A03
The potential of accelerator mass spectrometry (AMS) and radiocarbon in biomedical applications is being investigated by Lawrence Livermore National Laboratory (LLNL). A measurement of the dose-response curve for DNA damage caused by a carcinogen in mouse liver cells was an initial experiment. This demonstrated the sensitivity and utility of AMS for detecting radiocarbon tags and led to numerous follow-on experiments. The initial experiment and follow-on experiments are discussed in this report.

N91-18598# Texas A&M Univ., College Station. Dept. of Nuclear Engineering.
CONSIDERATIONS OF BETA AND ELECTRON TRANSPORT IN INTERNAL DOSE CALCULATIONS Progress Report
WESLEY E. BOLCH and JOHN W. POSTON, SR. Dec. 1990 46 p
(Contract DE-FG05-88ER-60707)
(DE91-006251; DOE/ER-60707/T1) Avail: NTIS HC/MF A03
Ionizing radiation has broad uses in modern science and medicine. These uses often require the calculation of energy deposition in the irradiated media and, usually, the medium of interest is the human body. Energy deposition from radioactive sources within the human body and the effects of such deposition are considered in the field of internal dosimetry. In July of 1988, a three-year research project was initiated by the Nuclear Engineering Department at Texas A and M University under the sponsorship of the U.S. Department of Energy. The main thrust of the research was to consider, for the first time, the detailed spatial transport of electron and beta particles in the estimation of average organ doses under the Medical Internal Radiation Dose (MIRD) schema. At the present time (December of 1990), research activities are continuing within five areas. Several are new initiatives begun within the second or third year of the current contract period. They include: (1) development of small-scale dosimetry; (2) development of a differential volume phantom; (3) development of a dosimetric bone model; (4) assessment of the new ICRP lung model; and (5) studies into the mechanisms of DNA damage. A progress report is given for each of these tasks within the Comprehensive Report. In each use, preliminary results are very encouraging and plans for further research are detailed within this document.

N91-18599# National Aerospace Medical Centre, Soesterberg (Netherlands).
THE INCIDENCE OF SLEEP DISTURBANCES IN DUTCH COCKPIT CREW OPERATING ON TRANSMERIDIAN ROUTES
(ETN-91-99697) Avail: NTIS HC/MF A03
An inquiry into the occurrence of sleep disturbances among cockpit crew of two Dutch commercial airlines is described. Questionnaires were sent to 1191 cockpit crewmembers. Each anonymized questionnaire comprised 24 items concerning sleep and the use of sleeping aids at home and on route over the last 6 months. The Groningen sleep quality scale was used to evaluate the quality of sleep. The response percentage was 60. A positive correlation between operating on transmeridian flights and complaints about the quality of sleep was demonstrated. The sleep quality en route was significantly worse than at home. Forty seven percent of the transmeridian flying crewmembers with sleep disturbances judged their disturbed sleep to affect their performance in the cockpit. Among the sleeping aids used during lay overs were alcohol (42 percent) and hypnotics (10 percent). It is concluded that transmeridian operations cause significant complaints about the quality of sleep in a large group of Dutch cockpitcrew. A disturbed sleep and the use of sleeping aids, such as alcohol and hypnotics might affect flight safety.

N91-18600# Los Alamos National Lab., NM.
A COMPUTATIONAL MODEL OF THE CEREBELLUM
(Contract W-7405-ENG-36)
(DE91-004824; LA-UR-90-3733; CONF-9007190-1) Avail: NTIS HC/MF A02
The need for realistic computational models of neural microarchitecture is growing increasingly apparent. While traditional neural networks have made inroads on understanding cognitive functions, more realism (in the form of structural and connectivity constraints) is required to explain processes such as vision or motor control. A highly detailed computational model of mammalian cerebellum was developed. It is being compared to physiological recordings for validation purposes. The model is also being used to study the relative contributions of each component to cerebellar processing.

53 BEHAVIORAL SCIENCES

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

A91-24320#
THE NOE FLIGHTS AND THEIR EFFECT UPON A PILOT
The effects of NOE helicopter flight on pilot emotional state
and eyesight use are discussed in view of flight tests, encompassing six 'horizontal' and four 'vertical' maneuvers, which were conducted by a Mi-2 helicopter. These tests have revealed a differentiation in the effect of maneuvers on the emotional state of the pilot; the most distressing maneuvers were those involving a coupling of vertical maneuvers with rapid descent. Heartbeat rates exceeding normal by 60 percent were recorded in such cases. Oculographic tests confirmed that the pilot's sight is not stabilized in one direction during NOE, but rather alternates between the outside and the instrument panel. This underscores the need for incorporating HUDs on NOE-mission helicopters. O.C.

A91-25100

VERTICAL DISPARITIES AND PERCEPTION OF THREE-DIMENSIONAL SHAPE

Random dot stereograms are used here in a shape judgment task to show that changes in vertical disparities have no effect on perceived three-dimensional shape. Changes in ocular convergence do alter perceived shape, suggesting substantial changes in the subjects' scaling of horizontal disparities. It is concluded that vertical disparities are not used to scale disparities for viewing distance, and that extraretinal signals must be considered when analyzing human three-dimensional shape perception. C.D.

A91-26782

AVIATION PSYCHOLOGY
RICHARD S. JENSEN, ED. (Ohio State University, Columbus) Aldershot, England and Brookfield, VT, Gower Technical, 1989, 438 p. For individual items see A91-26783 to A91-26797. Copyright

Topics presented include a study of the human factors in the super cockpit, the cognitive demands of automation in aviation, some implications of automation on air traffic control, and special considerations for helicopter safety. Also presented are personality assessment in aviator selection, the selection and screening programs for air traffic control specialists, aircrew performance assessment, and human performance aspects of aircraft accidents. R.E.P.

A91-26789

PILOT DECISION MAKING AND JUDGEMENT
ROSS TELFER IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 154-175. refs Copyright

Evaluation and results are discussed that cover the pilot judgment studies instituted by the FAA to develop, evaluate and implement appropriate training materials and methods. To evaluate pilot judgments in a realistic setting, flight students submit to a flight check conducted by an experienced flight instructor. After each flight the instructor rates the pilot performance on each judgment situation on the basis of a five point scale ranging from four (sound judgment) to zero (dangerous judgment) with the judgment situation on the basis of a five point scale ranging from four (sound judgment) to zero (dangerous judgment). R.E.P.

A91-26792

MEASURES OF IN-FLIGHT WORKLOAD

As both system performance and safety are dependent on operator workload, NASA, the FAA and all three services are evaluating and developing empirical measures of workload to be utilized in flight. A review is presented of this evaluation including a general description, a discussion of weaknesses and strengths, and guidelines for utilization. Two common elements defining pilot workload are what the pilot is required to accomplish with the aircraft and the conditions under which the required operation is to be conducted. There are three uses for workload measurement: (1) to predict the workload demands of a particular system configuration before it reaches production or simulation, (2) to assess workload demands of already existing systems, and (3) the online monitoring of workload. Finally, a summary of workload validation studies is presented. R.E.P.

A91-26793

PERSONALITY ASSESSMENT IN AVIATOR SELECTION

This paper examines the personality factors employed to predict performance in aviation. Historical information on the methods developed during and after World War I to develop applied psychology in the aviator selection process is presented. In general, results obtained were not favorable when personality inventories were validated against performance criteria. The principal reason for this was that the preselection of candidates eliminated abnormal individuals, and that performance measures were unreliable and invalid. Various tests conducted by the U.S. military air services and British and Scandinavian forces are described. New automated behavior-based inventories are discussed and it is shown that aviation selection appears to be most promising in the area of computer administration and in concealing the personality trait of interest. R.E.P.

A91-26794

SELECTION AND SCREENING PROGRAMS FOR AIR TRAFFIC CONTROL

A review is presented of the training, responsibilities, and screening programs for the air traffic control specialist in the FAA. The selection and screening process that applies to those ATCS personnel assigned to the terminal and enroute options is described. Each candidate for the position is continually evaluated, from an initial aptitude selection test battery through performance-based screening at the FAA Academy, and eventually in on-the-job training, performed at the facility assigned. Due to the critical safety-related aspects of the work, screening and identifying characteristics in individuals that can predict successful operation in air traffic are particularly important. General selection guidelines are discussed along with selection procedures, the FAA Academy, effectiveness of the placement process, and the utility of ATCS academy screening. R.E.P.

A91-26795

AIRCrew PERFORMANCE ASSESSMENT

Aircrrew performance measurement is the act of determining the quantity, quality, and dimensions of aicrew performance by comparison against a standard. The three principal applications for aircrrew performance measurement are aircrrew selection, aircrrew training, and research. An evaluation of the C-130 weapon system trainer is presented as an example to identify and discuss various
measurement and methodology issues that are relevant to the evaluation of students, media, and aircrew training methods in a real-world environment. Expert systems focusing on air combat are also discussed and it is shown that this technique may be applied to other measurement areas, particularly those necessitating the evaluation of performance in complex situations and higher order aircrew proficiency. R.E.P.

A91-26796

HUMAN PERFORMANCE ASPECTS OF AIRCRAFT ACCIDENTS

ALAN E. DIEHL


Copyright

An overview is presented of the theory and practice of investigating the human performance aspects of aircraft accidents. The complex issues involved in the investigation procedures are discussed along with case studies which show the potential benefits of conducting detailed human performance analyses. Psychologists are becoming an integral part of the modern interdisciplinary teams that investigate civil and military aviation accidents. The basic role of these psychologists is to assist in systematically recording and explaining the effects of factors connected with human performance degradation. Details are provided on the accident causation, investigation, and prevention processes including the role played by the flight surgeon, research psychologist, and human factor advocates.

R.E.P.

A91-27826*

National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

COCKPIT NAPPING


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The results of a NASA-sponsored study examining the effectiveness of a brief, preplanned cockpit rest period to improve pilot alertness and performance in nonaugmented long-haul flight operations are discussed. Four regularly scheduled trans-Pacific flights were studied. The shortest flight legs were about 7 h and the longest about 9.5 h, with duty periods averaging about 11 h layovers approximately 25 h. Three-person B747 crews were divided randomly into two volunteer pilot groups. These crews were nonaugmented, and therefore no relief pilots were available. The rest group, consisting of four crews, was allowed a 40 min opportunity to rest during the overwater cruise portion of the flight. On a preplanned, rotating basis, individual crew members were allowed to nap. It is concluded that a preplanned cockpit nap is associated with significantly better behavioral performance and higher levels of physiological alertness and that this can be accomplished without disrupting normal flight operations or compromising safety.

L.K.S.

A91-28169*

National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

OPTIMAL DISPLACEMENT IN APPARENT MOTION AND QUADRATURE MODELS OF MOTION SENSING

ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) Vision Research (ISSN 0042-6993), vol. 30, no. 9, 1990, p. 1392-1393. refs

Copyright

A grating appears to move if it is displaced by some amount between two brief presentations, or between multiple successive presentations. A number of recent experiments have examined the influence of displacement size upon either the sensitivity to motion, or upon the induced motion aftereffect. Several recent motion models are based upon quadrature filters that respond in opposite quadrants in the spatiotemporal frequency plane. Predictions of the quadrature model are derived for both two-frame and multiframe displays. Quadrature models generally predict an optimal displacement of 1/4 cycle for two-frame displays, but in the multiframe case the prediction depends entirely on the frame rate.

N91-17044*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

IN-FLIGHT CREW TRAINING


Avail: NTIS HC/MF A99 CSCL 051

The Helmet Mounted Display system and Part Task Trainer are two projects currently underway that are closely related to the in-flight crew training concept. The first project is a training simulator and an engineering analysis tool. The simulator's unique helmet mounted display actually projects the wearer into the simulated environment of 3-D space. Miniature monitors are mounted in front of the wearer's eyes. Partial Task Trainer is a kinematic simulator for the Shuttle Remote Manipulator System. The simulator consists of a high end graphics workstation with a high resolution color screen and a number of input peripherals that can be used to construct the equivalent of the RMS control panel on the back of the Orbiter. It is being used in the training cycle for Shuttle crew members. Activities are underway to expand the capabilities of the Helmet Display System and the Part Task Trainer.

Author

N91-18577# Joint Publications Research Service, Arlington, VA.

PSYCHOLOGICAL PREPARATION OF OPERATORS FOR ACTIVITY DURING SUSTAINED G-LOADS

A.A. OBOZNOV, V. A. PONOMARENKO, and D. YU.*

ARKHANGELSKY


Avail: NTIS HC/MF A04

The timely performance by an operator of protective measures (primarily the tensing at will of leg and abdominal muscles) prevents the development of visual disturbances accompanying G-loading and thus increases the reliability of his activity. The development of a special mental quality in the operator - the ability to divide one's attention between carrying out an operator task and performing protective measures - is the most important element in the psychological preparation of the individual for successful performance of operator tasks in conditions involving sustained G-loads. The possibility of developing a two-tiered system of mental regulation in ordinary conditions is studied.

Y.S.

N91-18588# Joint Publications Research Service, Arlington, VA.

COLOR SELECTION IN LUSCHER TEST AS EMOTIONAL STATUS INDICATOR IN FLIGHT PERSONNEL Abstract Only

O. N. KUZNETSOV, V. A. YEGOROV, and B. S. FRANTSEN


Avail: NTIS HC/MF A04

Color selection in the Luscher test was used in the assessment of emotional status of flight instructors in various field-related situations. In comparison with the population at large, flight personnel showed preference for cooler colors, such as blue, green, or violet. This preference is taken to reflect emotional stress encountered by the pilots in day-to-day situations. In particular, preference for violet and green, a mixture of blue and red or blue and yellow, is understood to reflect adaptability and flexibility in the face of stress.

Author

N91-18593# Joint Publications Research Service, Arlington, VA.

NEUROTIC AND PSYCHOSOMATIC RISK FACTORS IN FLIGHT PERSONNEL Abstract Only

V. I. YEVDOKIMOV

In its JPRS Report: Science and Technology. USSR: Life Sciences p 5 14 Sep. 1990 Transl. into ENGLISH
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

54

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

A91-24322#

MILITARY AIRCREW HEAD SUPPORT SYSTEM


This paper describes research work undertaken in order to determine a suitable method of supporting the military pilot's head during high 'g' maneuvers, enabling him to maintain his head in an upright position, thereby enhancing his ability to monitor Head-Up Displays, and increasing his awareness of the situation outside the cockpit. The paper also describes how the Military Aircrew Head Support System can serve as an effective head restraint system during an ejection from the aircraft. A description is given of the work carried out to date and proposals for further work are also discussed.

A91-24339#

MODERN OXYGEN AND ANTI-G PROTECTION FOR THE PILOT OF ADVANCED FIGHTER AIRCRAFT SAAB JAS 39


A fighter pilot oxygen supply and anti-g regulation system has been designed which employs both a high performance anti-g valve and manually-selectable Assisted Positive Pressure Breathing, and uses the gaseous oxygen supply as the basis of both g-valving and the pressure breathing regulator. The system provides an electronic warning monitor for the breathing function which is expected to be eventually extended to the anti-g function. This combination of pneumatic and electronic technologies is expected to furnish the highest levels of safety and performance.

A91-25845

A NEW TWO-DIMENSIONAL 'MAN-WCV' MATHEMATICAL MODEL OF THE HUMAN THERMOREGULATION

XIUGAN YUAN and BIN SHA (Beijing University of Aeronautics and Astronautics, People's Republic of China) Chinese Journal of Aeronautics (ISSN 1000-9361), vol. 3, Nov. 1990, p. 266-276. refs Copyright

In this paper, a new two-dimensional 'man-WCV' (water cooling vest) mathematical model is developed. This model is of practical use: it can predict transient temperature responses and body temperature distribution for a person in a nonuniform hot environment, doing various jobs and dressed in different clothes. In addition, the results calculated from the model can be used to optimize the distribution of the tube-net lined on the WCV and to evaluate an individual thermal conditioning system with cooling water. The results obtained from the model agree well with experimental data.

A91-26608*

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE NASA TELEROBOTICS RESEARCH PROGRAM


An account is given to NASA efforts in the development of space telerobotics, which encompass mission analyses, core technology research, systems-integration testbed evaluations, ground-based demonstrations, and flight experiments. Space telerobotics applications encompass (1) The Space Shuttle Satellite Servicing System, (2) the Space Shuttle Orbiter's Remote Manipulator System, (3) the Space Station Freedom's Flight Telerobotics Servicer, Mobile Servicing Center, and Japanese Experiment Module, and (4) planetary rovers. A fundamental role is being played by NASA-Marshall, which possesses a Teleoperator and Robotics Evaluation Facility.

A91-26620

SIMULATION SYSTEM FOR A SPACE ROBOT USING 6 AXIS SERVOS

H. SHIMOJI, M. INOUE, K. TSUCHIYA (Mitsubishi Electric Corp., Amagasaki, Japan), K. NINOMIYIA, I. NAKATANI (Institute of Space and Astronautical Science, Sagamihara, Japan) et al. IN: Automatic

The development of a space robot with a manipulator which is operated to catch and handle a target, in zero gravity environment, is described. In this case, the behavior of the robot main body caused by the reaction force exerted by the manipulator motion has to be taken into consideration in order to control the manipulator correctly. To solve this problem, a ground simulation system combining numerical simulation and servo mechanisms was constructed. On this system, dynamics of the space robot and the target is solved based on the momentum conservation law, and the relative motion between them is realized. Using this simulation system, space robots can be developed efficiently.

Author

A91-26621

THEORETICAL AND EXPERIMENTAL STUDY ON IN-ORBIT CAPTURE OPERATION WITH SATELLITE MOUNTED MANIPULATOR


This paper treats both theoretical and experimental studies on a control problem of a space free-flying space manipulator, with an aim of developing a new control method for trajectory tracking or target capturing, considering the dynamical interaction between the manipulator arm and the base vehicle in space microgravity environment. In the theoretical study, the generalized Jacobian matrix (GJM) concept is introduced. By means of this new matrix, the conventional control methods for ground-fixed manipulators are directly applicable for space manipulators. In the experimental study, a laboratory model of a robot satellite supported on air bearings is developed in order to simulate the free-flying behavior of mechanical links in microgravity environment. An on-line resolved motion rate control scheme with vision feedback is developed for experimenting capture operations, utilizing the GJM. The experimental results confirm the validity of the GJM concept and the proposed control method.

Author

A91-26622

SIMULATION AND CONTROL OF SPACE MANIPULATORS BEARING COMPLEX PAYLOADS


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Payloads to be handled by space manipulators cannot always be considered as inert bodies represented by mass and inertias. Modeling is considered in this paper from the point of view of the connection of a dynamic model of a payload to a general purpose multibody simulation package. Control issues are discussed in the framework of dynamic control, where the overall control loop is split up between an inner force control loop dependent only on the manipulator parameters, and an outer payload control loop whose adaptation to large inert and complex payloads is investigated.

Author

A91-26783

HUMAN FACTORS IN THE SUPER COCKPIT


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This paper presents a review of the evolution of the man-machine interface leading up to the super cockpit, identifying the most significant problems and the technical approaches recommended to resolve them. Technically, the super cockpit faces many problems including: sensor and display processing, reliability, logistics and maintainability requirements, optics, pilot acceptance, and human factors. The concept of generating a 'virtual world' and a 'pilot's associate' are the most controversial issues. It is noted that the sensor fusion display development task should be organized towards for application to the super concept in its three areas of development going from the present, near-future, and far-future state-of-the-art.

R.E.P.

A91-26784

CREW SYSTEMS DESIGN - SOME DEFENCE, PSYCHOLOGY FUTURES


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Airborne early warning (AEW) Nimrod system design and development is examined with particular regard to the aircrew facilities aspects. The system is compared to those systems employed aboard both the U.S. AWACS and F/A 16 aircraft. Only the AEW Nimrod utilizes duplicated scanners with limited transverse, which necessitates further duplication of scanner control and stabilization, a good part of the radar, electronic surveillance, and the IFF radar. A human-centered approach is recommended for future crew systems design, with a return to a more active role in the control loop for the human operator, aided by AI information management and decision support systems, basically directed at preserving adaptive control. It is noted that automation technology will be more acceptable and effective if it works in a fashion qualitatively similar to the way humans work and if it is adaptive and flexible.

R.E.P.

A91-26785

SPEECH TECHNOLOGY IN THE COCKPIT


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Speech technology concerning human/machine interaction refers to voice input/output technology, where voice input is realized by use of a machine correctly identifying one of 'n' possible words, utterances or phrases and the voice output provides feedback, cautions, warnings or advisories to the talker/operator, while conducting in-flight, cockpit related applications and functions. Considerations that are addressed include speech synthesis, speech recognition, recognition algorithms, and the problems with cockpit application of speech recognition. It is concluded that template matching, isolated word, speaker dependent ASR systems are the only systems that appear to be viable for cockpit applications for the foreseeable future.

R.E.P.

A91-26786

COGNITIVE DEMANDS OF AUTOMATION IN AVIATION


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This paper focusses on the main cognitive tasks required of pilots in the face of automation. Both subjective and objective assessment techniques are evaluated and discussed. In order to understand the cognitive demands that the pilot experiences, it is necessary to understand the basic cognitive processing characteristics of the pilot, and devise methods for evaluating levels of cognitive demands. An empirical approach to understanding these cognitive demands on the pilot is described, which in turn identifies where automation is needed most. Cognitive demands, and therefore the necessity for automation, were evaluated by performance and subjective workload ratings. The performance data indicated that there was resource competition between the two tasks that were determined a priori to rely heavily on the response resources, i.e., the target acquisition and flight control tasks.

R.E.P.
A91-26787
IMPLICATIONS OF AUTOMATION ON AIR TRAFFIC CONTROL
DAVID HOPKIN IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 96-108. refs Copyright

Air traffic control faces the continuous requirement to maintain and enhance its current high standards of efficiency and safety, while handling constantly increasing demands for ATC services from a great variety of operators. A review is presented on the implications of automation that include system constraints, ergonomics, staffing levels, error reduction, workload, stress, allocation of functions, and professional knowledge and attitudes. As for ergonomics, compromises have to be reached, taking into account the frequency and sequence in which controls and displays must be utilized to perform the complete range of tasks. R.E.P.

A91-26788
SIMULATION

An evolutionary overview of the simulator in aviation is presented. It is increasingly applied for flight crew training, systems training, and research into advanced flight technology. Simulators are utilized for three principal purposes: to facilitate the design of systems by allowing experimentation with different system configurations and modes of utilization without the requirement of constructing an actual system, to support applied and basic research in the definition of the fundamental principles of system operation, and to train personnel in the utilization and operation of systems. Further descriptions and details are provided on the uses of training simulators, the transfer of training, the simulator as a training device, the control of aircraft motion, simulator design and fidelity, and the simulator instructional system. R.E.P.

A91-26791
THE EYES PREFER REAL IMAGES

For better or worse, virtual imaging displays are with us in the form of narrow-angle combining-glass presentations, head-up displays (HUD), and head-mounted projections of wide-angle sensor-generated or computer-animated imagery (HMD). All military and civil aviation services and a large number of aerospace companies are involved in one way or another in a frantic competition to develop the best virtual imaging display system. The success or failure of major weapon systems hangs in the balance, and billions of dollars in potential business are at stake. Because of the degree to which national defense is committed to the perfection of virtual imaging displays, a brief consideration of their status, an investigation and analysis of their problems, and a search for realistic alternatives are long overdue. Author

A91-26832 Massachusetts Inst. of Tech., Cambridge.
MIT-NASA/KSC SPACE LIFE SCIENCE EXPERIMENTS - A THEORETICAL STUDY

Experiments performed at MIT to better define Space Station information system telepresence requirements for effective remote coaching of astronauts by principal investigators (PI) on the ground are described. The experiments were conducted via satellite video, data, and voice links to surrogate crewmembers working in a laboratory at NASA's Kennedy Space Center. Teams of two PIs and two crewmembers performed two different space life sciences experiments. During 19 three-hour interactive sessions, a variety of test conditions were explored. Since bit rate limits are necessarily imposed on Space Station video experiments surveillance video frame rate, resolution, grey scale, and color decimation was investigated. It is concluded that remote coaching by voice works and that dedicated crew-Pi voice loops would be of great value on the Space Station. L.K.S.

A91-26833 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
TELESCIENCE - OPTIMIZING AEROSPACE SCIENCE RETURN THROUGH GEOGRAPHICALLY DISTRIBUTED OPERATIONS

The paper examines the objectives and requirements of teleoperations, defined as the means and process for scientists, NASA operations personnel, and astronauts to conduct payload operations as if these were colocated. This process is described in terms of Space Station era platforms. Some of the enabling technologies are discussed, including open architecture workstations, distributed computing, transaction management, expert systems, and high-speed networks. Recent testbedding experiments are surveyed to highlight some of the human factors requirements. L.M.

A91-26834 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
APPLIED HUMAN FACTORS RESEARCH AT THE NASA JOHNSON SPACE CENTER HUMAN-COMPUTER INTERACTION LABORATORY

The applied human factors research program performed at the NASA Johnson Space Center's Human-Computer Interaction Laboratory is discussed. Research is conducted to advance knowledge in human interaction with computer systems during space crew tasks. In addition, the Laboratory is directly involved in the specification of the human-computer interface (HCI) for space systems in development (e.g., Space Station Freedom) and is providing guidelines and support for HCI design to current and future space missions. Author
A91-26835* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

WORKSPACE VISUALIZATION AND TIME-DELAY TELEROBOTIC OPERATIONS

The paper examines the performance of telerobotic tasks where the operator and robot are physically separated, and a communication time delay of up to several seconds between them exists. This situation is applicable to space robotic servicing-assembly-maintenence-operations on low earth or geosynchronous orbits with a ground-based command station. Attention is given to two developments which address advanced time-delay teleoperations for unstructured tasks: (1) the 'phantom robot', a real-time predictive graphics simulator developed to allow teleoperator eye-to-hand coordination or robot free-space kinematics under a time delay of several seconds; and (2) shared compliance control, a modified form of automatic electromechanical impedance control employed in parallel with manual position control to permit soft contact and grasp compliance with workpiece geometry under a time delay of several seconds.

L.M.

A91-26836

NEW DESIGN STRATEGIES AND TECHNOLOGIES FOR OPERATOR-MACHINE INTERFACE FOR SPACE PLATFORM DESIGN, OPERATIONS, AND PLANNING

It is proposed that considerable gains in efficiency can be achieved in the areas of space platform design and construction as well as in the planning and execution of space operations by the application of recent advances in manufacturing technology. The advances which are considered applicable include the concurrent design or engineering strategy and new sensor capabilities which will perform wrist force sensing and target location determination. It is pointed out that these devices can augment the capabilities of conventional manipulator devices.

L.M.

A91-26837*

MATERIAL MANIPULATOR CONTROL FROM ORBITER FOR SPACE STATION ASSEMBLY

This paper discusses the assembly process of the Space Station Freedom. It is shown that the assembly of the Space Station will require 29 flights of the Space Shuttle Orbiter: six shuttle flights during the initial assembly stage when the Space Station will not have sufficient life-support capability; seven more flights before the Station will support human occupation independent of the presence of the Space Shuttle; and 16 more flights for achieving full operational capability. The shuttle systems to be used in the Space Station assembly are described together with the results of simulation and analyses. Special attention is given to the Space Shuttle Remote Manipulator System which will be available on all Shuttle flights to support the Space Station assembly.

J.S.

A91-26903

CURRENTS INDUCED IN AN ANATOMICALLY BASED MODEL OF A HUMAN FOR EXPOSURE TO VERTICALLY POLARIZED ELECTROMAGNETIC PULSES
JIN-YUAN CHEN and OM P. GANDHI (Utah, University, Salt Lake City) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. 39, Jan. 1991, p. 31-39. USAF-supported research. refs Copyright

The finite-difference time-domain (FDTD) technique is used to calculate the internal fields and the induced current densities in anatomically based models of a human using 5628 or 45,024 cubical cells of dimensions 2.62 and 1.31 cm, respectively. A layer of dielectric constant of epsilon(r) = 4.2 and having a thickness of 2.62 cm is assumed under the foot to simulate a human wearing rubber-soled shoes. The total induced currents for the various sections of the body and the specific absorptions for several organs are given for two representative electromagnetic pulses. The calculated results for the induced currents are in excellent agreement with the data measured for a human subject. The FDTD method is ideally suited for exact representation of the pulse shapes and offers numerical efficiency to allow detailed modeling of the human body and the various organs.

A91-26926

ACTIVE FORCE REFLECTION DEVICES IN TEOOPERATION
D. W. REPPERGER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 11, Jan. 1991, p. 52-56. refs Copyright

A methodology for designing force-reflecting active controllers in cases involving teleoperation is presented. Certain types of force loop are shown to provide more information about the environment to the human that improves interaction. The procedure of modulating the controller to match the integral of its inverse mechanical impedance to the plant is given. Experimental data involving subjects are used to validate the approach.

A91-27694

BIOSPHERE II - CLOSED ECOLOGICAL SYSTEMS ENGINEERING

This paper provides a general description of the Biosphere II project - a 3.15 acre materially closed ecological system containing tropical rainforest, savannah, marsh, desert, intensive agriculture and human habitat biomes - currently under construction and scheduled for completion in September 1990. It further describes the approach taken to solve particular problems that arise due to the fact that the system is completely materially closed and contains several complex ecosystems. Materials selection for avoidance of contamination and methods of controlling contamination are discussed. A method for pumping water which is benign to life forms in the water is described. Systems choices are strongly influenced by the criterion of no external resupply of equipment, spare parts, or consumables for very long durations. The Biosphere II project is aimed at creating regenerative ecological systems as life habitat prototypes for space locations, and to conduct ecological research applicable to the biosphere of the earth.

Author

A91-27695*

CONCEPTUAL DESIGN FOR A LUNAR-BASE CELSS

Future human exploration is key to the United States National...
Space Policy goal of maintaining a world leadership position in space. In the past, spacecraft life support systems have used open-loop technologies that were simple and sufficiently reliable to demonstrate the feasibility of spaceflight. A critical technology area needing development in support of both long duration missions and the establishment of lunar or planetary bases is regenerative life support. The information presented in this paper describes a conceptual design of a Lunar Base Controlled Ecological Life Support System (LCELSS) which supports a crew size ranging from 4 to 100. The system includes, or incorporates interfaces with, eight primary subsystems. An initial description of the Lunar-Base CELSS subsystems is provided within the framework of the conceptual design. The system design includes both plant (algae and higher plant) and animal species as potential food sources.

**A91-27696**

**INVESTIGATION OF HVAC SYSTEMS IN LOW GRAVITY APPLICATION**


The paper has been developed to identify and summarize the principal areas of investigation necessary to design and install functional HVAC systems in low gravity applications. These investigations must consider design, construction and control details and restrictions for systems and components. Included in these investigations should be subjects such as the mechanics of prime movers in lunar gravity, temperature and pressure requirements, air distribution methods and physical size, transport velocity requirements, resources recovery interface with life support systems and both energy consumption and conservation. A suggestion of priorities for the investigations is presented. These priorities have been established to support development of basic design criteria and methods for functional HVAC systems. Further investigation of more detailed subjects can be performed at a later date.

**A91-27697**

**COMPOSTING FOR LUNAR AGRICULTURE**


A study is presented of alternative technologies for the microbially mediated biological oxidative transformation of human and other organic wastes. Continuous process and batch mode composters are developed to convert waste materials into a form that is a useful input for lunar agriculture. Waste materials are composted during a period of time and the composted material that results is added to an engineered soil in plant growth chambers. It is shown that composting technology utilized in conjunction with a regolith-derived soil for agriculture permits organic wastes to be effectively recovered for reuse in the production of food.

**A91-27698**

**FLUID BEHAVIOR CONSIDERATIONS FOR WASTE MANAGEMENT IN LOW-GRAVITY ENVIRONMENTS**

ANTHONY M. WACHINSKI (U.S. Air Force Academy, Colorado Springs, CO) and KURT T. PRESTON (Purdue University, West Lafayette, IN) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1242-1248. refs Copyright

Design of waste recycling systems for spacecraft requires a knowledge of fluid behavior in microgravity. As gravity is reduced, phenomena usually ignored in the One-G environment of earth can dominate physical or biological processes. This paper provides an explanation of Zero-G, microgravity terminology, and microgravity fluid behavior. Its purpose is to educate civil engineers and waste management professionals on Zero-G basics.

**A91-27708**

**A PROTOTYPE MODEL FOR HUMAN/AUTOMATION TRADE-OFFS**

RICHARD JOHNSON (Colorado, University, Boulder) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1334-1343. refs Copyright

Future space construction missions will involve both human and machine constructors. Selection of the optimum constructor mix requires a model of constructor capabilities and requirements. The database for that model is developed via extrapolation from current literature. Optimization is done via minimization of total mission cost using a linear programming approach. This prototype is the first cut at producing a general tool for choosing a near-optimum constructor mix for any space construction mission. The linear programming optimization model illuminates several significant representational and data-gathering problems. 

**A91-27712**

**ARTIFICIAL GRAVITY - HUMAN FACTORS DESIGN REQUIREMENTS**

STEPHEN D. CAPPS (Boeing Aerospace and Electronics, Huntsville, AL) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1374-1382. refs Copyright

The effects of prolonged exposure to weightlessness on humans are considered. The challenge of creating environments conducive to the average human as well as creating the means of human survival for extended space flight and settlement is examined. Since the environment created by spinning a vehicle differs substantially from earth gravity, design limitations such as artificial gravity level, gravity gradient, Coriolis forces, tangential motion, and locomotion are analyzed. The results of adaptation schedule experiments are presented. A set of human factors design requirements pertaining to the upper level of angular velocity, upper and lower gravity levels, gravity gradients, radial traffic, transport across spin axis, and human activity at the hub is recommended. Rotating habitats are considered to be the only comprehensive solution for determining the exact human factors envelope.

**A91-27713**

**PARTIAL GRAVITY - HUMAN IMPACTS ON FACILITY DESIGN**

STEPHEN CAPPS (Boeing Aerospace and Electronics, Huntsville, AL) and NATHAN MOORE (NASA, Johnson Space Center, Houston, TX) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1383-1392. refs Copyright

Partial gravity affects the body differently than earth gravity and microgravity environments. The main difference from earth gravity is human locomotion; while the main difference from microgravity is the specific updown orientation and reach envelopes which increase volume requirements. Much data are available on earth gravity and microgravity design; however, very little information is available on human reactions to reduced gravity levels in IVA situations (without pressure suits). Therefore, if humans commit to permanent lunar habitation, much research should be conducted in the area of partial gravity effects on habitat design.

**A91-27717**

**WORKING ON THE MOON - THE APOLLO EXPERIENCE**

ERIC M. JONES (Los Alamos National Laboratory, NM) IN:

Copyright

During the six completed landing missions, Apollo lunar surface crews conducted 160 astronaut-hours of EVAs and also conducted a similar sum of procedures. The ability to land equipment and consumables was very modest but, despite stay times of no more than 32 hours, the crews of Apollos 11, 12, and 14 were able to test their mobility and their capability of doing useful work outside the spacecraft. For the last three missions, thanks to landing module modifications which enabled landings with significant amounts of cargo, stay times more than doubled to three days. The crews were able to use lunar rovers to conduct extensive local exploration and to travel up to 10 km away from their immediate landing sites. Author

A91-27727
LEVEL OF RECYCLING EFFECTIVENESS
Copyright

The Level of Recycling Effectiveness (LORE) scale is presented. It is a conceptual framework for evaluating recycling and other alternative strategies of meeting needs in space activities. The LORE scale is developed, defined, and examples of its use are given. The LORE scale should help reduce planning time by serving as a framework within which initial thinking can take place when selecting between alternatives. Author

N91-17048* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

PAYLOAD DEPLOYMENT SYSTEMS AND ADVANCED MANIPULATORS
Avail: NTIS HC/ MF A99 CSCL 05H

The results of discussions on future development of avionics to support payload deployment systems and advanced manipulators are discussed. The discussions summarized here were held during the Space Transportation Avionics Technology Symposium in Williamsburg, Virginia on November 7 to 9, 1989. Symposium participants agreed that this subpanel would have benefitted from more participation by users. It was suggested that inputs from Shuttle payload users should be incorporated, either by direct discussions with users or by incorporating comments from users as kept by Payload Accommodations. The Jet Propulsion Laboratory (JPL), Goddard, and Langley, as builders of payloads, and the Space Station Utilization Office could also provide useful inputs. Other potential users for future systems should also be identified as early as possible to determine what they anticipate their needs to be. Symposium participants also recognized that payload deployment is normally not a safety critical area, and as such, is vulnerable to budget cuts that defer costs from development to operations. This does give opportunities for upgrades of operational systems, but these must be very cost effective to compete with vehicle requirements that enhance safety or increase lifetime. Author

N91-17542# Air Force Human Resources Lab., Brooks AFB, TX. Logistics and Human Factors Div.

EDWARD S. BOYLE, JILL A. EASTERLY, and JOHN D. IANNI Jul. 1990 23 p Submitted for publication

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Copyright

This paper describes a new direction in human factors research called Design Evaluation for Personnel, Training, and Human Factors (DEPTH). This research utilized computer-aided design (CAD) man-modeling and data base technologies to foster a human-centered approach to weapon system design. The ability to graphically simulate maintenance work underlies this research. Visualizing maintenance tasks will allow more accurate and complete descriptions of human performance requirements during design. This man-modeling capability will utilize a computer graphic workstation capable of importing CAD data and will build upon technology developments of CREW CHIEF, a model of a maintenance technician developed by Air Force Human Resources Laboratory (AFHRL) and Armstrong Aerospace Medical Research Laboratory (AAMRL). Additional capabilities include detailed hand and vision models, multi-person task performance simulation, the effects of environmental, and animated simulations of complete maintenance tasks. Logistics Support Analysis (LSA), training, and personnel information will be derived from these simulations and presented in a usable format.

N91-17543# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE CONTROL OF HUMAN ARM MOVEMENT: MODELS AND MECHANICAL CONSTRAINTS Ph.D. Thesis
DAVID L. BENNETT Jun. 1990 202 p
(Contract N00014-86-K-0180; N00014-85-K-0124; NIH-AM-26710) (AD-A228869; AI-TR-1234) Avail: NTIS HC/MF A10 CSCL 05/8

The role is studied of structured models in autonomous motor learning. Any autonomous system, such as the human motor system, has only the internal consistency of its various sensors to rely upon for model building (learning). To study the possibility of learning structured models from internal consistency constraints, the specific problem of learning the kinematic parameters (relative link orientations and length) of general revolute joint manipulators is explored. First it is noted that a manipulator may form a mobile closed kinematic chain when interacting with the environment, if it is redundant with respect to the task degrees of freedom (DOFs) at the endpoint. Then it is demonstrated that if the mobile closed chain assumes a number of configurations, then loop consistency equations permit joint angle readings; endpoint sensing is not required.

N91-17544# Brookhaven National Lab., Upton, NY. Dept. of Nuclear Energy.

ADVANCED HUMAN-SYSTEM INTERFACE DESIGN REVIEW GUIDELINES

Advanced, computer-based, human-system interface designs are emerging in nuclear power plant (NPP) control rooms. These developments may have significant implications for plant safety in that they will greatly affect the ways in which operators interact with systems. At present, however, the only guidance available to the U.S. Nuclear Regulatory Commission (NRC) for the review of control room-operator interfaces, NUREG-0700, was written prior to these technological changes; therefore, it is not designed to address them. The objective of the project reported in this paper is to develop an Advanced Control Room Design Review Guideline for use in performing human factors reviews of advanced operator interfaces. This guideline will be implemented, in part, as a portable, computer-based, interactive document for field use. The paper describes the overall guideline development methodology, the present status of the document, and the plans for further guideline testing and development.

DOE

123
today surfaces as: What causes crewmembers to commit errors in judgment, performance, or perception, and how might the influences of such causes be reduced. Progress in the field of human factors (HF) analysis has revealed some solutions while advancing the fundamental goal of flight safety - mishap prevention. The impact of HF studies on mishap prevention is clarified and summarized and how aircrew fatigue is a common denominator among HF elements is shown. Accepted techniques for combating and coping with fatigue are listed. Finally, recommendations on how to maintain operational awareness of aircrew fatigue considerations are proposed.

STEPHENS F. MCCAULEY In AGARD, Progress in Military Airlift Command Perspective

JAMES SOUSA in AGARD, Progress in Military Airlift 9 p Dec. 1990

Copyright Avail: NTIS HC/MF A14; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The effort of the Military Airlift Command (MAC) and the Air Force System Command (AFSC) to improve aircrew eye/respiratory protection (AERP) system is summarized. The significant effort to plan the concept, manage the acquisition, design the system, test the system, and redesign the system to meet the MAC requirements is discussed. The MAC mission to conduct and support operations remains the same during war and peacetime and despite the presence of chemical agents. An effective AERP system is needed to support the worldwide operations. The ongoing, test effort has uncovered important problems and challenges to overcome. However, after hundreds of ground and over 50 flight test hours in the MAC mission environment, solutions are on the way. More challenges exist now, but the numerous hurdles already cleared have prepared a way to proceed.
and volume requirements, each subsystem must be evaluated in these terms.

N91-18128 L Florida Univ., Gainesville.
IMPLEMTATION OF SENSOR AND CONTROL DESIGNS FOR BIOREGENERATIVE SYSTEMS
Avail: NTIS HC/MA 14 CSCL 06/11
The EGM 4000/4001 Engineering Design class is an interdisciplinary design course that allows students to experience the design process. The projects involved the design of sensors and subsystems of a closed-loop life support system (CLLSS) with special emphasis on the Controlled Ecological Life Support System (CLLSS) currently being developed at Kennedy Space Center (KSC) by NASA. To understand the work performed by the students, one must understand the purpose and concept of a CLLSS system. In the years to come, NASA will be constructing Moon bases and sending astronauts to other worlds on extended space missions. In order to support the crews, unreasonable large quantities of supplies would have to be sent from Earth. These supplies would be difficult to transport and require large holds. To remedy this problem, NASA plans to incorporate crops into the spacecraft. These crops would supply food for the crews, as well as provide beneficial psychological side effects. In addition, the plants would recycle the air and human waste and provide oxygen and water for the mission. The students in the design class were to work on supporting this project. In order to do this successfully, the course was separated into two phases. The first semester involved studying the various aspects of a CLLSS to determine sensing needs and develop ideas. The second semester involved first determining which of the ideas were most promising. Specific sensors were then designed and tested under laboratory conditions with promising results. Finally, recommendations for further development were proposed. Atmosphere and temperature control, nutrient delivery, plant health and propagation, and resource recycling are discussed.

N91-18137 L Kansas State Univ., Manhattan.
AUTOMATION OF CLOSED ENVIRONMENTS IN SPACE FOR HUMAN COMFORT AND SAFETY
Avail: NTIS HC/MA 14 CSCL 06/11
The Environmental Control and Life Support System (ECLSS) for the Space Station Freedom and future colonization of the Moon and Mars presents new challenges for present technologies. Current plans call for a crew of 8 to live in a safe, shirt-sleeve environment for 90 days without ground support. Because of these requirements, all life support systems must be self-sufficient and reliable. The ECLSS is composed of six subsystems. The temperature and humidity control (THC) subsystem maintains the cabin temperature and humidity at a comfortable level. The atmosphere control and supply (ACS) subsystem insures proper cabin pressure and partial pressures of oxygen and nitrogen. To protect the space station from fire damage, the fire detection and extinguishers. The waste management (WM) subsystem compacts solid wastes for return to Earth, and collects urine for water recovery. Because it is impractical, if not impossible, to supply the station with enough fresh air and water for the duration of the space station's extended mission, these elements are recycled. The atmosphere revitalization (AR) subsystem removes CO2 and other dangerous contaminants from the air. The water recovery and management (WRM) subsystem collects and filters condensate from the cabin to replenish potable water supplies, and processes urine and other waste waters to replenish hygiene water supplies. These subsystems are not fully automated at this time. Furthermore, the control of these subsystems is not presently integrated; they are largely independent of one another. A fully integrated and automated ECLSS would increase astronauts' productivity and contribute to their safety and comfort. The Kansas State University Advanced Design Team is in the process of researching and designing controls for the automation of the ECLSS for Space Station Freedom and beyond. The approach chosen to solve this problem is to divide the design into three phases. The first phase is to research the ECLSS as a whole system and then concentrate efforts on the automation of a single subsystem. The AR subsystem was chosen for our focus. During the second phase, the system control process will then be applied to the AR subsystem.

HABITABILITY: CAMELOT 4
Avail: NTIS HC/MA 14 CSCL 06/11
During 1988 to 1989 the NASA/USRA Advanced Design Program sponsored research and design efforts aimed at developing habitability criteria and at defining a habitability concept as a useful tool in understanding and evaluating dwellings for prolonged stays in extraterrestrial space. The Circulating Auto sufficient Mars-Earth Luxurious Orbital Transport (CAMELOT) was studied as a case in which the students would try to enhance the quality of life of the inhabitants by applying architectural design methodology. The study proposed 14 habitability criteria considered necessary to fulfill the defined habitability concept, which is that state of equilibrium that results from the interaction between components of the Individual Architecture Mission Complex, which allows a person to sustain physiological homeostasis, adequate performance, and acceptable social relationships. Architecture, design development, refinements and revisions to improve the quality of life, new insights on artificial gravity, form and constitution problems, and the final design concept are covered.

GENESIUS LUNAR OUTPOST: AN EVOLUTIONARY LUNAR HABITAT
Avail: NTIS HC/MA 14 CSCL 06/11
Students at the University of Wisconsin-Milwaukee Department of Agriculture undertook a series of studies of lunar habitats during the 1989 to 1990 academic year. Undergraduate students from architecture and mechanical and structural engineering with backgrounds in interior design, biology and construction technology were involved in a seminar in the fall semester followed by a design studio in the spring. The studies resulted in three design alternatives for lunar habitation and an integrated design for an early stage lunar outpost.

PYSCHOLOGICAL ASSESSMENT OF HORIZON INDICATORS IN PLANES Abstract Only
Avail: NTIS HC/MA 04 CSCL 06/11
Psychological studies were conducted on optimum horizon indicators in view of recent findings demonstrating that more than 20 percent of airplane accidents are attributed to spatial disorientation, and that this number is increasing. Trials conducted with flight simulators demonstrated that a display depicting an aircraft in flight against a stationary horizon, i.e., depiction of spatial relationship in a geocentric system of coordinates, facilitates spatial perception in comparison with a moving-horizon display. The key

125
disadvantage of the latter method lies in the requirement for additional information processing necessary for reorientation of the information into geocentric coordinates.

Author

**BASIC RESEARCH IN HUMAN FACTORS Interim Report, 1984 - 1988**  
HAROLD VANCOTT and ELIZABETH NEILSEN Jul. 1989 47 p  
(Contact MDA903-38-C-0031) (AD-A226318; ARI-RN-90-79) Avail: NTIS HC/MF A03 CSCL 23/2  
This report outlines the purpose, membership, and recent activities of the Committee of Human Factors. It summarizes current studies in the areas of human performance models, multicolored displays, distributed decision making, expert systems, and aging. The report also discusses reports from 1984 through 1988 that represent the areas listed above.

Author

N91-18603# National Aeronautics and Space Administration, Washington, DC.  
**SPACESUIT GUIDEBOOK**  
1991 24 p  
(NASA-PED-117; NAS 1.84:117) Avail: NTIS HC/MF A03 CSCL 06/11  
This guidebook is designed to supplement the Spacesuit wall chart (WAL-114) published by the Education Affairs Division, January 1990. The wall chart depicts Astronaut Bruce McCandless on his historic first untethered spacewalk using the manned maneuvering unit. He flew on Shuttle mission 41-B, and ventured 100 meters for the Shuttle's cargo bay and returned safely. This guidebook explains in depth the elements depicted on the wall chart in see-through and cut-away perspectives. Together the wall chart and guidebook show as well as explain the inside workings of the spacesuit and its various components. Forty separate elements are identified with an accompanying numerical legend. Those elements are further explained in this guidebook along with their functions and how they work in relation to other elements. Additional chapters discuss essential components of the spacesuit such as the primary life support system and the manned maneuvering unit, and the method for donning the spacesuit.

Author

N91-18604# Lawrence Livermore National Lab., CA. Systems and Human Performance.  
**HUMAN ENGINEERING DESIGN CONSIDERATIONS FOR THE USE OF SIGNAL COLOR ENHANCEMENT IN ASW DISPLAYS**  
WILLIAM W. BANKS Nov. 1990 89 p  
(Contract W-7405-ENG-48) (DE91-004949; UCRL-ID-105261) Avail: NTIS HC/MF A05 CSCL 06/11  
The Lawrence Livermore National Laboratory's (LLNL) requested to examine and define man-machine limits as part of the Office of Naval Technology's High Gain Initiative program (HGI). As an initial investigative area, LLNL's Systems and Human Performance effort focused upon color display interfaces and the use of color enhancement techniques to define human and system interface limits in signal detection and discrimination tasks. The knowledgeable and prudent use of color in different types of display is essential to facilitate human visual detection, discrimination and recognition in complex visual tasks. The consideration and understanding of the complex set of interacting variables associated with the prudent use of color is essential to optimize human performance, especially in the ASW community. The designers of advanced display technology and signal processing algorithms may be eventually called upon to present pre-processed information to ASW operators and researchers using the latest color enhancement techniques. These techniques, however, may be limited if one does not understand the complexity and limits of human information processing which reflects the assessed state of knowledge relevant to the use of color in displays. The initial sections of this report discuss various aspects of color presentation and the problems typically encountered, while the last section deals with a specific research proposal required to further our understanding and proper use of color enhancement methods.

DOE

N91-18605# National Aerospace Medical Centre, Soesterberg (Netherlands).  
**ENVIRONMENTAL FACTORS INFLUENCING FLIGHT CREW PERFORMANCE**  
Developments in commercial aviation have changed the pilot's task to that of a flight systems manager. In this task optimum vigilance is required. It is anticipated that the performance of the modern pilot might be impaired by the cumulative effects of frequent disturbance of sleep and prolonged exposure to mild hypoxia, low relative humidity, ozone, and noise. The effects of loss of sleep, lower cabin pressure, low relative humidity, ozone, and noise on a pilot's performance is discussed. Research on the effects of the combination of environmental factors on performance is recommended. Such research should include controlled studies under cockpit environmental conditions, employing over time assessment of psychological performance, and using tasks that are representative for the task of a modern pilot. Conditions to be included in such a study are given.

ESA

N91-18606# National Aerospace Medical Centre, Soesterberg (Netherlands). Dept. of Research and Development.  
**COCKPIT-ENVIRONMENTAL FACTORS DURING LONG-RANGE FLIGHTS**  
M. SIMONS Apr. 1989 52 p Sponsored by Civil Aviation Authority, Netherlands. (REPT-89-02-RLD; ETN-91-98699) Avail: NTIS HC/MF A04  
As a result of the increase of the average sector length flown by most international airlines, flight crew is exposed to the aircraft cabin environment for a longer period of time. Scientific literature is reviewed with respect to the effects of prolonged (greater than 8 hours) exposure to cockpit environmental conditions on well being and performance of flight crew. The effects of cabin pressure, relative humidity, ozone, cosmic radiation, noise and vibration are discussed in detail. Recommendations for future studies are formulated.

ESA

N91-19014# New Mexico Highlands Univ., Las Vegas. Dept. of Engineering Technology.  
**BIOREGENERATIVE LIFE SUPPORT**  
Bioregenerative life support systems utilize plant growth for food, water, and atmosphere revitalization. Simulation studies of a simplified model are presented that suggest survivability in the face of partial plant growth chamber failure. Simulation studies demonstrate the potential for a bioregenerative life support system on an extended mission. In addition to robustness and survivability in terms of the food supply, the plant growth chamber produces exactly the right amount of oxygen for the crew's metabolic needs. The amount of water taken up by the plants during food production is balanced by the crew's metabolic water production.  
Y.S.
EXERCISE PHYSIOLOGY

Air travel across four time zones in college swimmers p 107 A91-26559

EXOBIOLGY

Decreased susceptibility to motion sickness during exposure to visual illusion in microgravity p 108 A91-27963

Microbiology on Space Station Freedom [NASA-CR-130189] p 112 N91-18573

EXPERIMENTATION

A system analytical and experimental study of gravitropic reactions in plants [ETN-91-98568] p 105 N91-17532

EXPERT SYSTEMS

Teleoperation - Optimizing aerospace science return through geographically distributed operations [AAS PAPER 90-203] p 120 A91-26833

Working on the moon - The Apollo experience p 122 A91-27717

EXTRAVEHICULAR ACTIVITY

Human design strategies and technologies for operator-machine interface for space platform design, operations, and planning [NASA PAPER 80-00] p 121 A91-26836

EXTRAVEHICULAR MOBILITY UNITS

A practical evaluation of a neutral buoyancy facility p 109 A91-27869

EXTRAVEHICULAR MOBILITY UNITY MODELS


EXREMELY LOW FREQUENCIES

ELF (Extremely-Low-Frequency) field interactions at the animal, tissue and cellular levels [DE91-004307] p 111 N91-17537

EYE (ANATOMY)

Functional asymmetry of paired organs and the professional efficiency of pilots p 108 A91-25250

Aircrave eye/respiratory protection: A military artiff function p 114 N91-18571

EYE EXAMINATIONS

Prediction of space motion sickness susceptibility by discontinuity ear torsion in parabatic flight p 108 A91-27662

EYE MOVEMENTS

Comparison of smooth pursuit and combined eye-head tracking in human subjects with deficient labyrinthine function p 109 A91-28163

Behavior of human horizontal vestibulo-ocular reflex in response to high-acceleration stimuli p 110 A91-28170

F

FARM CROPS

Implementation of sensor and control designs for bioregenerative systems p 125 N91-18128

FATIGUE (BIOLOGY)

Circadian rhythm, sleep, and fatigue in aircrew operating on long-haul routes p 107 A91-26677

Circadian fatigue countermeasures p 124 N91-16077

FEEDBACK

The magnesium chelation step in chlorophyll biosynthesis [DE91-005619] p 105 N91-18571

FEEDBACK CONTROL

Simulation and control of space manipulation bearing complex payloads p 119 A91-26622

FERTILIZATION

Microenvironments during sea urchin fertilization - Fluorescence detection with rhodamine phalacidin p 102 A91-24780

Motility and centrosomal organization during sea urchin and mouse fertilization p 102 A91-24781

FIBER OPTICS

Diffractometrie and application of photoconductive device systems to studies of biological and organic materials [DE91-005297] p 105 N91-18571

FLIGHTER AIRCRAFT

Modern oxygen and anti-g protection for the pilot of advanced fighter aircraft SAAB JAS 39 p 118 A91-24332

FINITE DIFFERENCE THEORY

Currents induced in an anatomically based model of a human arm to measure control accuracy of electromagnetic pulses p 121 A91-26693

FLIGHT CHARACTERISTICS

Environmental factors influencing flight crew performance [ETN-91-98698] p 126 N91-18605

FLIGHT CREWS

Aviation psychology - Book p 116 A91-26762

Aircrew performance assessment p 116 A91-26795

Cockpit napping p 117 A91-27876

Flying hours and aircrew performance [AD-A226628] p 111 N91-17535

Gaze and age: Acquisition of a clinical data base for aircrew standards [AD-A229237] p 111 N91-17541

Aircrew fatigue countermeasures p 124 N91-18077

Cockpit, environmental factors during long-range flights p 102 A91-27960

FLIGHT FATIGUE

Cockpit napping p 117 A91-27826

Possibility of using evoked brain potentials to diagnose flight crew fatigue p 112 N91-18576

Neurological and psychosomatic risk factors in flight personnel p 117 N91-18593

Environmental factors influencing flight crew performance [ETN-91-98697] p 126 N91-18599

FLIGHT FITNESS

The incidence of sleep disturbances in Dutch cockpit crew operating on transmendial routes p 115 N91-18599

FLIGHT OPERATIONS

Simulation -- for flight training p 120 A91-28788

Effects of alcohol on pilot performance in simulated flight p 109 A91-27667

FLIGHT SIMULATORS

Simulation -- for flight training p 120 A91-28788

Possibility of using evoked brain potentials to diagnose flight crew fatigue p 112 N91-18576

FLIGHT STRESS

Relationships of anxiety scores to screening and training status at air traffic controllers p 119 A91-27966

FLIGHT ESSAYS (BIOLOGY)

The NOE flight's effects upon a pilot p 115 A91-24320

Medical support of parachute jumps p 106 A91-25210

Color selection in Luscher test as emotional status indicator in flight personnel p 117 N91-18568

Circladian patterns in plasma lipids, carbohydrates, and some hormones of healthy pilots p 114 N91-18576

Cockpit-environmental factors during long-range flights [REPT-89-002-PIL0] p 110 N91-17582

FLIGHT TESTS

Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure p 108 A91-26646

Aircrave eye/respiratory protection: A military artiff command perspective p 124 N91-18078

FLIGHT TRAINING

Piloting hours and aircrew performance [AD-A228562] p 111 N91-17555

FLUID MANAGEMENT

Fluid behavior considerations for waste management in low-gravity environments p 122 A91-27698

FLUORESCENCE

Microenvironments during sea urchin fertilization - Fluorescence detection with rhodamine phalacidin p 102 A91-24780

FREE FLIGHT

Theoretical and experimental study on in-orbit capture operation with satellite mounted manipulator p 119 A91-26621

G

GAS COMPOSITION

Alveolar gas composition and exchange during deep breath-hold diving and dry breath holds in elite divers p 107 A91-26560

GAS EXCHANGE

Alveolar gas composition and exchange during deep breath-hold diving and dry breath holds in elite divers p 107 A91-26560

GAS MIXTURES

Effect of hypoxia on psychomotor performance during graded exercise p 108 A91-27966

A-4
<table>
<thead>
<tr>
<th>Subject</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAMMALS</td>
<td></td>
</tr>
<tr>
<td>MAN COMPUTER INTERFACE</td>
<td></td>
</tr>
<tr>
<td>MAN MACHINE SYSTEMS</td>
<td></td>
</tr>
<tr>
<td>MANAGEMENT</td>
<td></td>
</tr>
<tr>
<td>MANIPULATORS</td>
<td></td>
</tr>
<tr>
<td>MANNEFING MANEUVERING UNITS</td>
<td></td>
</tr>
<tr>
<td>MANNED SPACE FLIGHT</td>
<td></td>
</tr>
<tr>
<td>MANUALS</td>
<td></td>
</tr>
<tr>
<td>MARIJUANA</td>
<td></td>
</tr>
<tr>
<td>MARS LANDING</td>
<td></td>
</tr>
<tr>
<td>MASS SPECTROMETERS</td>
<td></td>
</tr>
<tr>
<td>MEDICAL SERVICES</td>
<td></td>
</tr>
<tr>
<td>MEMBRANES</td>
<td></td>
</tr>
<tr>
<td>MENTAL PERFORMANCE</td>
<td></td>
</tr>
<tr>
<td>MICROBIOLOGY</td>
<td></td>
</tr>
<tr>
<td>MICROBIOLOGY APPLICATIONS</td>
<td></td>
</tr>
<tr>
<td>MICROORGANISMS</td>
<td></td>
</tr>
<tr>
<td>MICRO WAVES</td>
<td></td>
</tr>
<tr>
<td>MILITARY AIRCRAFT</td>
<td></td>
</tr>
<tr>
<td>MILITARY OPERATIONS</td>
<td></td>
</tr>
<tr>
<td>MINERAL METABOLISM</td>
<td></td>
</tr>
<tr>
<td>MISSION PLANNING</td>
<td></td>
</tr>
<tr>
<td>MODELS</td>
<td></td>
</tr>
<tr>
<td>MOLECULAR ABSORPTION</td>
<td></td>
</tr>
<tr>
<td>MOLECULAR STRUCTURE</td>
<td></td>
</tr>
<tr>
<td>MOODS</td>
<td></td>
</tr>
<tr>
<td>MOON</td>
<td></td>
</tr>
<tr>
<td>MORTION AFTEREFFECTS</td>
<td></td>
</tr>
<tr>
<td>MORTION PERCEPTION</td>
<td></td>
</tr>
<tr>
<td>MORTION SICKNESS</td>
<td></td>
</tr>
<tr>
<td>MUSCLES</td>
<td></td>
</tr>
<tr>
<td>MUSCULAR FATIGUE</td>
<td></td>
</tr>
<tr>
<td>NAP-OF-THE-EARTH NAVIGATION</td>
<td></td>
</tr>
<tr>
<td>NEUROPHYSIOLOGY</td>
<td></td>
</tr>
<tr>
<td>NEUTRAL BUOYANCY SIMULATION</td>
<td></td>
</tr>
<tr>
<td>NEUTRAL DIFFRACTION</td>
<td></td>
</tr>
<tr>
<td>NOISE</td>
<td></td>
</tr>
<tr>
<td>NUCLEAR MEDICINE</td>
<td></td>
</tr>
<tr>
<td>NUCLEAR POWER PLANTS</td>
<td></td>
</tr>
<tr>
<td>NYSTAGMUS</td>
<td></td>
</tr>
<tr>
<td>OCULOGRAVIC ILLUSIONS</td>
<td></td>
</tr>
<tr>
<td>OCULOMOTOR NERVES</td>
<td></td>
</tr>
<tr>
<td>OPERATOR PERFORMANCE</td>
<td></td>
</tr>
<tr>
<td>OPTIMIZATION</td>
<td></td>
</tr>
<tr>
<td>ORBITAL SERVICING</td>
<td></td>
</tr>
<tr>
<td>ORGANICLES</td>
<td></td>
</tr>
<tr>
<td>ORGANIC COMPOUNDS</td>
<td></td>
</tr>
<tr>
<td>ORGANIC MATERIALS</td>
<td></td>
</tr>
<tr>
<td>ORTHOSTATIC TOLERANCE</td>
<td></td>
</tr>
</tbody>
</table>

**A-6**
### Personal Author Index Listing

<table>
<thead>
<tr>
<th>Personal Author</th>
<th>Title</th>
<th>Report Number</th>
<th>Page Number</th>
<th>Accession Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABEL, L. A.</td>
<td>Frequency and velocity of rotational head perturbations during locomotion</td>
<td>p 110 A91-28184</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALEKSEEV, V. K.</td>
<td>Relationship between orthostatic stability and post-spaceflight vestibular function in man</td>
<td>p 113 N91-18586</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALEGUN, W.</td>
<td>Habitability: CAMELOT 4</td>
<td>p 125 N91-18150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARATOW, MICHAEL</td>
<td>Postural responses of head and foot cutaneous microvascular flow and their sensitivity to bed rest</td>
<td>p 109 A91-27970</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARKHANGELSKII, D. YU</td>
<td>Psychological preparation of operators for activity during sustained G-loads</td>
<td>p 117 N91-18577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARMSTRONG, DAVID W.</td>
<td>Effects of multiple cold air exposures on delayed matching to sample performance</td>
<td>p 110 N91-17534</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARNAUD, SARA B.</td>
<td>Postural responses of head and foot cutaneous microvascular flow and their sensitivity to bed rest</td>
<td>p 109 A91-27970</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASUKATA, ICHIRO</td>
<td>Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure</td>
<td>p 108 A91-26846</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAIR, W. J.</td>
<td>Revision of the ICRP dosimetric model for the human respiratory tract</td>
<td>p 114 N91-18594</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BALLENTINE, CHARLES S.</td>
<td>Glare and age: Acquisition of a clinical data base for aircrew standards</td>
<td>p 111 N91-17541</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BANKS, WILLIAM W.</td>
<td>Human engineering design considerations for the use of signal color enhancement in ASW displays</td>
<td>p 126 N91-18604</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARABASH, V. L.</td>
<td>Medical support of parachute jumps</td>
<td>p 106 A91-25210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARZEN, J. R.</td>
<td>Biodiversity and human impacts</td>
<td>p 104 N91-17530</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARRAGAN, A.</td>
<td>Habitability: CAMELOT 4</td>
<td>p 125 N91-18150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BASCHIERA, DINO</td>
<td>Genesis lunar outpost: An evolutionary lunar habitat</td>
<td>p 125 N91-18158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAUSSANT, RAYMOND</td>
<td>Modern oxygen and anti-gravity protection for the pilot of advanced fighter aircraft SAAB JAS 39</td>
<td>p 118 A91-24332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEJEKY, A. K.</td>
<td>Workspace visualization and time-delay telerobotic operations</td>
<td>p 121 A91-26835</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEKETOY, A. I.</td>
<td>Cerebral-vascular effects of motion sickness</td>
<td>p 113 N91-18594</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENNETT, DAVID J.</td>
<td>The control of human arm movement: Models and mechanical constraints</td>
<td>p 123 N91-17543</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIERBAUM, CARL R.</td>
<td>Task analysis and workload prediction model of the MH-60K mission and a comparison with UH-60A workload predictions, Volume 2: Appendices A through G</td>
<td>p 124 N91-17545</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BILLINGS, C. E.</td>
<td>Effects of alcohol on pilot performance in simulated flight</td>
<td>p 109 A91-27967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BODROV, V. A.</td>
<td>Functional asymmetry of paired organs and the professional efficiency of pilots</td>
<td>p 106 A91-25250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOER, L. C.</td>
<td>The selective listening task as a test for pilots and air traffic controllers</td>
<td>p 118 N91-18601</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOLCH, WESLEY E.</td>
<td>Considerations of beta and electron transport in internal dose calculations</td>
<td>p 115 N91-18598</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOLSTAD, GRETA</td>
<td>Effects of water temperature on performance - A practical evaluation of a neutral buoyancy facility</td>
<td>p 109 A91-27969</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOYLE, EDWARD S.</td>
<td>Design Evaluation for Personnel, Training, and Human Factors</td>
<td>p 122 N91-17547</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRAZHIKHIN, V. I.</td>
<td>Experimental assessment of effect of head position on center of gravity of human body in ejections seats</td>
<td>p 114 N91-18590</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BURNS, SUSAN H.</td>
<td>Multiple manipulator control from orbiter for Space Station assembly</td>
<td>p 121 A91-26837</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARTER, D.</td>
<td>Artificial gravity - Human factors design requirements</td>
<td>p 122 A91-27712</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARTER, M.</td>
<td>Habitability: CAMELOT 4</td>
<td>p 125 N91-18150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARTER, DANIEL</td>
<td>Crystallization of the Fab from a human monoclonal antibody against gp 41 of human immunodeficiency virus type I</td>
<td>p 104 A91-27918</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARTON, P.</td>
<td>Simulation and control of space manipulators bearing complex payloads</td>
<td>p 119 A91-26932</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Listings

<table>
<thead>
<tr>
<th>Personal Author</th>
<th>Title</th>
<th>Report Number</th>
<th>Page Number</th>
<th>Accession Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASALE, ELENA</td>
<td>Crystallization of the Fab from a human monoclonal antibody against gp 41 of human immunodeficiency virus type I</td>
<td>p 104 A91-26718</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEN, JIN-YUAN</td>
<td>Currents induced in an anatomically based model of a human for exposure to vertically polarized electromagnetic pulses</td>
<td>p 121 A91-26903</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHRETIEU, J. P.</td>
<td>Simulation and control of space manipulators bearing complex payloads</td>
<td>p 119 A91-26622</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLARK, STEPHEN NOWLAND</td>
<td>FED-X: The NIST express translator</td>
<td>p 111 N91-17563</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLINE, C. A.</td>
<td>Microfilaments during sea urchin fertilization - Fluorescence detection with rhodaminyl phalloidin</td>
<td>p 103 A91-24780</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLLINS, WILLIAM E.</td>
<td>Selection and screening programs for air traffic control</td>
<td>p 116 A91-26794</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONNELL, LINDA J.</td>
<td>Relationships of anxiety scores to screening and training status of air traffic controllers</td>
<td>p 109 A91-27956</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COSTA, MARIO</td>
<td>Alveolar gas composition and exchange during deep breath-hold diving and dry breath holds in elite divers</td>
<td>p 107 A91-26950</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CROMPTON, GEORGE H.</td>
<td>Habitation of motion sickness in the cat</td>
<td>p 104 A91-27964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CULLINGFORD, NATIVE S.</td>
<td>Conceptual design for a lunar-base CELSS</td>
<td>p 121 A91-26795</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUMMINING, B. G.</td>
<td>Vertical disparities and perception of three-dimensional shape</td>
<td>p 118 A91-25100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAVID, J. C.</td>
<td>New biomedical applications of radiocarbon</td>
<td>p 115 N91-18597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAYHOFF, J. E.</td>
<td>Toward modeling a dynamic biological neural network</td>
<td>p 104 A91-26516</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEAKIN, R. S.</td>
<td>Military Aircrew Head Support System</td>
<td>p 118 A91-24322</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMIRGOCHEYLAN, G. G.</td>
<td>Experimental assessment of effect of head position on center of gravity of human body in ejections seats</td>
<td>p 114 N91-18590</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMOSTHENES, T.</td>
<td>Effects of alcohol on pilot performance in simulated flight</td>
<td>p 109 A91-27967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMPSTER, WILLIAM F.</td>
<td>Biosphere II - Closed ecological systems engineering</td>
<td>p 121 A91-27964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIAMOND, SHIRLEY G.</td>
<td>Prediction of space motion sickness susceptibility by disconjugate eye torsion in parabolic flight</td>
<td>p 108 A91-27962</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIEHL, ALAN E.</td>
<td>Human performance aspects of aircraft accidents</td>
<td>p 117 A91-26706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DINGES, DAVID F.</td>
<td>Cockpit napping</td>
<td>p 117 A91-27926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DINST, L. L.</td>
<td>Changes in upper airway resistance during progressive normocapnic hypoxia in normal men</td>
<td>p 106 A91-26550</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORELLA, MARIO</td>
<td>Investigation of otolith responses using ground based vestibular research facility</td>
<td>p 111 N91-17536</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COSTA, MARIO</td>
<td>Alveolar gas composition and exchange during deep breath-hold diving and dry breath holds in elite divers</td>
<td>p 107 A91-26950</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRONFORD, GEORGE H.</td>
<td>Habitation of motion sickness in the cat</td>
<td>p 104 A91-27964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CULLINGFORD, NATIVE S.</td>
<td>Conceptual design for a lunar-base CELSS</td>
<td>p 121 A91-26795</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUMMINING, B. G.</td>
<td>Vertical disparities and perception of three-dimensional shape</td>
<td>p 118 A91-25100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAVIS, J. C.</td>
<td>New biomedical applications of radiocarbon</td>
<td>p 115 N91-18597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAYHOFF, J. E.</td>
<td>Toward modeling a dynamic biological neural network</td>
<td>p 104 A91-26516</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEAKIN, R. S.</td>
<td>Military Aircrew Head Support System</td>
<td>p 118 A91-24322</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMIRGOCHEYLAN, G. G.</td>
<td>Experimental assessment of effect of head position on center of gravity of human body in ejections seats</td>
<td>p 114 N91-18590</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMOSTHENES, T.</td>
<td>Effects of alcohol on pilot performance in simulated flight</td>
<td>p 109 A91-27967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEMPSTER, WILLIAM F.</td>
<td>Biosphere II - Closed ecological systems engineering</td>
<td>p 121 A91-27964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIAMOND, SHIRLEY G.</td>
<td>Prediction of space motion sickness susceptibility by disconjugate eye torsion in parabolic flight</td>
<td>p 108 A91-27962</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIEHL, ALAN E.</td>
<td>Human performance aspects of aircraft accidents</td>
<td>p 117 A91-26706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DINGES, DAVID F.</td>
<td>Cockpit napping</td>
<td>p 117 A91-27926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DINST, L. L.</td>
<td>Changes in upper airway resistance during progressive normocapnic hypoxia in normal men</td>
<td>p 106 A91-26550</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PERSONAL AUTHOR INDEX

KORNILSOVA, L. N.
Relationship between orthostatic stability and post-space flight vestibular function in man p 113 N91-18586

KROCK, LARRY P.
Errors in measurement of Gz acceleration tolerance p 109 A91-28794

KRYLOV, YU. V.
Relationship between vertical optokinetic nystagmus and susceptibility to motion sickness p 113 N91-18587

KUZNETSOV, O. N.
Color selection in Luscher test as emotional status indicator in flight personnel p 117 N91-18588

LACKNER, JAMES R.
Decreased susceptibility to motion sickness during exposure to visual inversion in microgravity p 108 A91-27983

LANDMANN, G.
Largest known microballes discovered in Lake Van, Turkey p 103 A91-25538

LANSKA, D. J.
Frequency and velocity of rotational head perturbations in locoemotion p 110 A91-28164

LAPA, V. V.
Psychological assessment of horizon indicators in planes p 110 A91-18584

LEGGETT, NICKOLAS
Composting for lunar agriculture p 122 A91-27997

LEIGH, R. J.
Comparison of smooth pursuit and combined eye-head tracking in human subjects with deficient labyrinthine function p 110 A91-28163

Frequency and velocity of rotational head perturbations during locoemotion p 110 A91-18584

Behavior of human horizontal vestibulo-ocular reflex in response to high-acceleration stimuli p 110 A91-28170

LEIRER, VON O.
Motor carry-over effects on aircraft pilot performance p 108 A91-27985

LEMSCHENKROH, N. A.
Psychological assessment of horizon indicators in planes p 125 N91-18582

LICHTENBERG, BYRON K.
Response to high-acceleration stimuli p 125 N91-18586

LINDSAY, S. M.
Microwave resonances in DNA [P90-261520] p 120 A91-28932

LOPEZ, D.
Habituation: CAMELOT 4 p 125 N91-18150

LUBEGA, SETH
Visualization of yeast chromosomal DNA p 106 N91-18993

LUCOT, JAMES B.
Habituation of motion sickness in the cat p 104 A91-27964

LUDWIG, DAVID A.
Errors in measurement of Gz acceleration tolerance p 109 A91-27974

MAAS, E. F.
Behavior of human horizontal vestibulo-ocular reflex in response to high-acceleration stimuli p 110 A91-28170

MAGEE, J. A.
Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25239

MAIKHAYLOV, V. M.
Relationship between orthostatic stability and post-space flight vestibular function p 113 N91-18586

MILLER, JAY C.
Measures of in-flight workload p 116 A91-26792

MISHRA, S. K.
Microbiology on Space Station Freedom p 110 A91-18573

MOORE, GARY T.
Genesis lunar outpost: An evolutionary lunar habitat p 125 N91-18158

MOORE, NATHAN
Partial gravity - Human impacts on facility design p 122 A91-27713

MOORE, THOMAS J.
Speech technology in the cockpit p 119 A91-26765

MORGAN, WILLIAM P.
Air travel across four time zones in college swimmers p 107 A91-25559

MORRIS, ANDREA L.
An extended model for electron spin polarization in photosynthetic bacteria [DE91-006091] p 105 N91-18569

MORRIS, ANDREA L.
An extended model for electron spin polarization in photosynthetic bacteria [DE91-006091] p 105 N91-18569

MORROW, DANIEL G.
Frequency and velocity of rotational head perturbations during locoemotion p 110 A91-18584

MOSKALENKO, YU. YE.
Mossification effects on airplane pilot performance p 108 A91-27965

MOYER, J.-UWE
Relationship between orthostatic stability and sustained G-loads p 117 N91-18577

MULLER, D. H.
Genetics and cosmic flight: A new evolutionary human habitat p 125 N91-18158

MYRSETH, EIRIK
Effect of water temperature on performance - A practical evaluation of a neutral buoyancy facility p 109 A91-27969

NAGASE, HIROFUMI
Cerebral-vascular effects of motion sickness p 125 N91-18584

NAKAMURA, HIDEMI
Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25239

NAKAMURA, HIROYUKI
Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25239

NAKATANI, I.
Simulation system for a space robot using 6 axis servos p 118 A91-26620

NEGRON, N.
Habituation: CAMELOT 4 p 125 N91-18158

NEILSEN, ELIZABETH
Basic research in human factors [AD-A226318] p 125 N91-18602

NEYHIS, J. J.
New design strategies and technologies for operator-machine interface for space platform design, operations, and planning [AAS PAPER 90-006] p 121 A91-26836

NIKOLAYEVA, T. G.
Circadian patterns in plasma lipids, carbohydrates, and some hormones of healthy pilots p 114 N91-18589

NINOMIYA, K.
Simulation system for a space robot using 6 axis servos p 118 A91-26620

NOEVE, DAVID A.
Bioconvection patterns, synchrony, and survival p 103 A91-24784

NOHARA, SEIICHI
Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25239

NORRIS, JAMES R.
An extended model for electron spin polarization in photosynthetic bacteria [DE91-006091] p 105 N91-18569

NOSI, R. F.
Biodiversity and human impacts [PB90-263963] p 104 N91-17530

NOZAWA, O.
Ocular motor interactions in sensory-motor processing [AD-A229111] p 111 N91-17540

NYE, LENDELL G.
Relationships of anxiety scores to screening and training status of air traffic controllers p 120 A91-27988

O'CONNOR, PATRICK J.
Air travel across four time zones in college swimmers p 107 A91-26559

O'HARA, D. B.
Effects of alcohol on pilot performance in simulated flight p 107 A91-27987

OKBOMOV, A. A.
Psychological preparation of operators for activity during sustained G-loads p 117 N91-18577

ODINAK, M. M.
Medical support of parachute jumps p 106 A91-25210

OGANOV, V. S.
Ultrasonic assessment of human tibia during 370-day antiorthostatic hypokinesia p 114 N91-18591

OHARA, JOHN M.
Advanced human-system interface design review guidelines [DE91-005386] p 123 N91-17544

OKUSHI, HIROFUMI
Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure p 126 A91-26646

OMAN, CHARLES M.
MIT/NASA/KSC space life science experiments - A practical evaluation of a neutral buoyancy facility [AAS PAPER 90-002] p 120 A91-26832

O'CONNOR, PATRICK J.
Air travel across four time zones in college swimmers p 107 A91-26559

O'HARA, D. B.
Effects of alcohol on pilot performance in simulated flight p 107 A91-27987

OZBONOV, A. A.
Psychological preparation of operators for activity during sustained G-loads p 117 N91-18577

ODINAK, M. M.
Medical support of parachute jumps p 106 A91-25210

OGANOV, V. S.
Ultrasonic assessment of human tibia during 370-day antiorthostatic hypokinesia p 114 N91-18591

OHARA, JOHN M.
Advanced human-system interface design review guidelines [DE91-005386] p 123 N91-17544

OKUSHI, HIROFUMI
Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure p 126 A91-26646

OMAN, CHARLES M.
MIT/NASA/KSC space life science experiments - A practical evaluation of a neutral buoyancy facility [AAS PAPER 90-002] p 120 A91-26832

PARKER, A. J.
Vertical disparities and perception of three-dimensional shape p 116 A91-25100

PARKER, DICK B.
Level of Recycling Effectiveness p 123 A91-27272

PASCHLE, ARVID
Effects of water temperature on performance - A practical evaluation of a neutral buoyancy facility p 109 A91-27969

PENG, CHEN
Glarre and age: Acquisition of a clinical data base for aircrew standards [AD-A229237] p 111 N91-17540

PEREZ-NEZDEZ, V.

PERRECHUT, PIERRE
Classical conditioning of ventilatory responses in humans p 107 A91-26557

PESHKOV, R. V.
Experimental assessment of effect of head position on center of gravity of human body in ejections seats p 114 N91-18590

B-3
PERSONAL AUTHOR INDEX

THURSTON, S. E.
Comparison of smooth pursuit and combined eye-head tracking in human subjects with deficient labyrinthine function p 110 A91-28163
Frequency and velocity of rotational head perturbations during locomotion p 110 A91-28164

TINNEY, D. T.
Biodiversity and human impacts [FS80-263963] p 104 N91-17530

TRAVIS, B. J.
A computational model of the cerebellum [DE91-004824] p 115 N91-18600

TSANG, PAMELA S.
Cognitive demands of automation in aviation p 119 A91-26786

TSUCHIYA, K.
Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25329

TURNER, JOEL G.
Air travel across four time zones in college swimmers p 107 A91-26559

U

UMETSU, MIKIO
Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure p 108 A91-26646

UMETANI, Y.
Theoretical and experimental study on in-orbit capture operation with satellite mounted manipulator p 119 A91-26621

V

VAKULENKO, V. M.
Stress and human circulation p 114 N91-18592

VALK, P. J. L.
The incidence of sleep disturbances in Dutch cockpit crew operating on transmeridian routes [ETN-91-966971] p 115 N91-18599

VANDYKE, HAROLD
Basic research in human factors [AD-A226318] p 126 N91-18602

VIDENI, V. S.
Medical support of parachute jumps p 106 A91-26210

VIDULICH, MICHAEL A.
Cognitive demands of automation in aviation p 119 A91-26786

VINGRYS, ALOIS J.
Reduced contrast sensitivity when viewing through an aircraft windscreen p 109 A91-27972

VOORHEES, MIKE
Methods for the development of a bioregenerative life support system p 124 N91-18127

VORDERMARK, DEBORAH S.
MIT-NASA/KSC space life science experiments - A teleseience testbed [AAS PAPER 90-002] p 120 A91-26632

VOROBIEV, O. A.
Relationship between vertical optokinetic nystagmus and susceptibility to motion sickness p 113 N91-18587

VOSKRESENSKIY, A. D.
Relationship between orthostatic stability and post-space flight vestibular function in man p 113 N91-18586

WAAG, WAYNE L.
Aircrew performance assessment p 116 A91-26795

WACHINSKI, ANTHONY M.
Fluid behavior considerations for waste management in low-gravity environments p 122 A91-27968

WATSON, ANDREW B.
Optimal displacement in apparent motion and quadrature models of motion sensing p 117 A91-28169

WEGMANN, HANS-MARTIN
Circadian rhythm, sleep, and fatigue in aircrews operating on long-haul routes p 107 A91-26797

WEIL, JOHN V.
Auricular carotid body hypoxic sensitivity after prolonged hypoxic exposure p 107 A91-26558

WEINSTEIN, JON
The magnesum chelation step in chlorophyll biosynthesis [DE91-006619] p 105 N91-18571

WEINISCH, ELISABETH
Crystallization of the Fab from a human monoclonal antibody against gp 41 of human immunodeficiency virus type I p 104 A91-28158

WHITE, T. R.
Effects of alcohol on pilot performance in simulated flight p 109 A91-27967

WHITNEY, D. E.
New design strategies and technologies for operator-machine interface for space platform design, operations, and planning [AAS PAPER 90-006] p 121 A91-26636

WITKOWSKI, R.
The NOE flights and their effect upon a plot p 115 A91-24320

WOGAN, CHRISTINE F.
Meteorology on Space Station Freedom [NASA-CP-3108] p 112 N91-18573

WOLF, DAVID A.
A culture vessel with large perfusion area to volume ratio [NASA-CASE-MSC-21662-1] p 104 N91-17531

Y

YAMAZAKI, JUNKO
The biochemical effects of 2G three-week continuous centrifugation on bone strength and muscle tissue components in cockerels p 104 A91-26645

YANSON, KH. A.
Ultrasound assessment of human tibia during 370-day antorthostatic hypokinesia p 114 N91-18591

YATES, J. TERRY
Gaze and age: Acquisition of a clinical data base for aircrew standards [AD-A229237] p 111 N91-17541

YEGOROV, S. V.
Possibility of using evoked brain potentials to diagnose flight crew fatigue p 112 N91-16576

YEGOROV, V. A.
Color selection in Luscher test as emotional status indicator in flight personnel p 117 N91-18588

YEVERIKOV, V. I.
Neurotic and psychosomatic risk factors in flight personnel p 117 N91-18593

YOKOTA, KUMINOB
Relation between cardiovascular responses and body tilting angles p 106 A91-25306

YOSHIDA, K.
Theoretical and experimental study on in-orbit capture operation with satellite mounted manipulator p 119 A91-26621

YUAN, XIUGAN
A new two-dimensional 'man-WCV mathematical model of the human thermoregulation p 118 A91-25645

Z

ZACHARIASSEN, ELI
A system analytical and experimental study of gravitropic reactions in plants [ETN-91-96556] p 105 N91-17532

ZARITSKAYA, V. V.
Relationship between vertical optokinetic nystagmus and susceptibility to motion sickness p 113 N91-18587

ZHERNAKOV, A. F.
Relationship between orthostatic stability and post-space flight vestibular function in man p 113 N91-18586

ZHERNAKOV, O. V.
Possibility of using evoked brain potentials to diagnose flight crew fatigue p 112 N91-18576

ZIMMERMAN, WAYNE
Telerobotic control issues related to real task applications in the space environment [AAS PAPER 90-054] p 120 A91-26825
## Typical Corporate Source Index Listing

<table>
<thead>
<tr>
<th>CORPORATE SOURCE</th>
<th>TITLE</th>
<th>REPORT NUMBER</th>
<th>PAGE NUMBER</th>
<th>ACCESSION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argonne National Lab., IL.</td>
<td>Protection by WR-2721 and WR-151327 against late</td>
<td>[DE90-017792]</td>
<td>p 4</td>
<td>N91-11352</td>
</tr>
<tr>
<td>Akron Univ., OH.</td>
<td>Toward modeling a dynamic biological neural network</td>
<td>[AD-A224757]</td>
<td>p 123</td>
<td>N91-17542</td>
</tr>
<tr>
<td>Anacapa Sciences, Inc., Fort Rucker, AL.</td>
<td>Frequency and velocity of rotational head perturbations during locomotion</td>
<td>[AAS PAPER 90-003]</td>
<td>p 120</td>
<td>A91-26833</td>
</tr>
<tr>
<td>Clemson Univ., SC.</td>
<td>The magnesium chelation step in chlorophyll biosynthesis</td>
<td>[DE91-006619]</td>
<td>p 105</td>
<td>N91-18571</td>
</tr>
<tr>
<td>Cleveland Clinic Foundation, OH.</td>
<td>Comparison of smooth pursuit and combined eye-head tracking in human subjects with deficient labyrinthine function</td>
<td>[AAS PAPER 90-004]</td>
<td>p 111</td>
<td>N91-17540</td>
</tr>
<tr>
<td>Cornell Environmental Research Lab., OR.</td>
<td>Biodiversity and human impacts</td>
<td>[PB90-263963]</td>
<td>p 104</td>
<td>N91-17530</td>
</tr>
<tr>
<td>Dartmouth Coll., Hanover, NH.</td>
<td>Multimodal interactions in sensory-motor processing</td>
<td>[AD-A291111]</td>
<td>p 111</td>
<td>N91-17540</td>
</tr>
<tr>
<td>Florida State Univ., Tallahassee.</td>
<td>Microfilaments during sea urchin fertilization - Fluorescence detection with rhodaminyl phalloidin</td>
<td>[AD-A229647]</td>
<td>p 124</td>
<td>N91-17545</td>
</tr>
<tr>
<td>Florida Univ., Gainesville.</td>
<td>Implementation of sensor and control designs for bioregenerative systems</td>
<td>[PB90-261520]</td>
<td>p 104</td>
<td>N91-17529</td>
</tr>
<tr>
<td>Brandeis Univ., Waltham, MA.</td>
<td>Decreased susceptibility to motion sickness during exposure to visual inversion in microgravity</td>
<td>[DE91-005452]</td>
<td>p 105</td>
<td>N91-18570</td>
</tr>
<tr>
<td>Lockheed Engineering and Sciences Co., Houston, TX.</td>
<td>Applied human factors research at the NASA Johnson Space Center Human-Computer Interaction Laboratory</td>
<td>[DE91-004949]</td>
<td>p 126</td>
<td>N91-18604</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>COUNTRY OF INTELLIGENT ORIGIN</th>
<th>PAGE NUMBER</th>
<th>ACCESSION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAIN</td>
<td>Evaluation of female and male aircrew applicants using a cognitive and psychomotor test</td>
<td>p 15 A91-11366</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>Reduced contrast sensitivity when viewing through an aircraft windscreen</td>
<td>p 109 A91-27972</td>
</tr>
<tr>
<td>CANADA</td>
<td>Changes in upper airway resistance during progressive normocapnic hypoxia in normal men</td>
<td>p 106 A91-26555</td>
</tr>
<tr>
<td>CHINA, PEOPLE'S REPUBLIC OF</td>
<td>A new two-dimensional &quot;man-WCV&quot; mathematical model of the human thermoregulation</td>
<td>p 118 A91-25845</td>
</tr>
<tr>
<td>FRANCE</td>
<td>Modern oxygen and anti-g protection for the pilot of advanced fighter aircraft SAAB JAS 39</td>
<td>p 118 A91-24322</td>
</tr>
<tr>
<td>GERMANY, FEDERAL REPUBLIC OF</td>
<td>Largest known microbealities discovered in Lake Van, Turkey</td>
<td>p 103 A91-26538</td>
</tr>
</tbody>
</table>

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

### J

**JAPAN**
- Effects of cold, noise and whole body vibration stress on neurotransmitters in the rat brain p 103 A91-25239
- Relation between cardiovascular responses and body tilting angles p 106 A91-25330
- Evidence for hypoxic depression of CO2-ventilation response in carotid body-responded humans p 107 A91-26556
- Simulation system for a space robot using 6 axis servos p 118 A91-26620
- Theoretical and experimental study on in-orbit capture operation with satellite mounted manipulator p 119 A91-26621
- Day-night variation of heat loss response to internal body heating in freely moving rats p 103 A91-26800
- The biochemical effects of 2G three-week continuous centripitalization on bone strength and muscle tissus components in cockerels p 104 A91-26845
- Alteration of circadian rhythm of plasma cortisol after eastward flight and the effect of light exposure p 108 A91-26846

### N

**NETHERLANDS**
- The incidence of sleep disturbances in Dutch cockpit crew operating on transatlantic routes [ETN-91-98597] p 115 N91-18599
- The selective listening task as a test for pilots and air traffic controllers [IZF-1990-A-16] p 116 N91-18601
- Environmental factors influencing flight crew performance [ETN-91-98698] p 126 N91-18605
- Cockpit-environmental factors during long-range flights [REPT-89-02-RLD] p 126 N91-18606

### P

**POLAND**
- The NOE lights and their effect upon a pilot p 115 A91-24230

**PUERTO RICO**
- Habitability: CAMELOT 4 p 125 N91-18590

### S

**SWITZERLAND**
- Aviolar gas composition and exchange during deep breath-hold diving and dry breath holds in elite divers p 107 A91-26560

### U.S.S.R.
- Medical support of parachute jumps p 106 A91-25210
- Functional asymmetry of paired organs and the professional efficiency of pilots p 106 A91-25250
- Thermal-neutrality zone in the human body under thermal adaptation p 106 A91-25296
- Potential of the redox state of the rabbit brain cortex under hypoxia (immobilization stress) p 103 A91-25297
- Psychological preparation of operators for activity during sustained G-loads p 117 N91-18577
- The mechanism of the drug resistance of escherichia in cosmonauts p 112 N91-18578

### D-1

Orthostatic stability of athletes of different specializations and its change as produced by lower gravity p 112 N91-18575
- Possibility of using evoked brain potentials to diagnose flight crew fatigue p 112 N91-18576
- Psychological preparation of operators for activity during sustained G-loads p 117 N91-18577
- Pharmacological regulation of physiological functions in space medicine p 113 N91-18580
- Effect of graded physical stress on cerebral hemodynamics in pilots p 113 N91-18581
- Psychological assessment of horizon indicators in planes p 125 N91-18582
- Cerebro-vascular effects of motion sickness p 113 N91-18584
- Central and systemic hemodynamics in simulated weightlessness p 113 N91-18585
- Relationship between orthostatic stability and post-space flight vestibular function in man p 113 N91-18586
- Relationship between vertical optokinetic nystagmus and susceptibility to motion sickness p 113 N91-18587
- Color selection in Luscher test as emotional status indicator in flight personnel p 117 N91-18588
- Circadian patterns in plasma lipids, carbohydrates, and some hormones of healthy pilots p 114 N91-18589
- Experimental assessment of effect of head position of center of gravity of human body in ejections seats p 114 N91-18590
- Ultrasonic assessment of human tibia during 370-day antorthostatic hypokinesia p 114 N91-18591
- Stress and human circulation p 114 N91-18592
- Neurotic and psychosomatic risk factors in flight personnel p 117 N91-18593
- Military Aircrew Head Support System p 118 A91-24322
- Vertical disparities and perception of three-dimensional shape p 116 A91-25100
- Human factors in the super cockpit p 116 A91-26783
- Crew systems design - Some defiance, psychology futures p 119 A91-26784
- Speech technology in the cockpit p 119 A91-26785
- Cognitive demands of automation in aviation p 119 A91-26796
- Implications of automation on air traffic control p 120 A91-26769
- Simulation p 120 A91-26789
- Pilot decision making and judgement p 116 A91-26789
- The eyes prefer real images p 120 A91-26791
- Measures of in-flight workload p 116 A91-26792
- Personality assessment in aviator selection p 116 A91-26793
- Selection and screening programs for air traffic control p 116 A91-26794
- Aircrew performance assessment p 116 A91-26795
- Human performance aspects of aircraft accidents p 117 A91-26796
- Circadian rhythm, sleep, and fatigue in aircrew operating on long-haul routes p 107 A91-26797

**FOREIGN TECHNOLOGY INDEX**

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 350)

June, 1991
CONTRACT NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 350)       June 1991

Typical Contract Number Index Listing

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>PAGE NUMBER</th>
<th>ACCESSION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAG2-413</td>
<td>p 16</td>
<td>N91-11380</td>
</tr>
</tbody>
</table>

Listings in this index are arranged alphabetically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under the contract are shown. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

AF PROJ. 2313 ................................................. p 111 N91-17540
AF PROJ. 2540 ................................................. p 123 N91-17542
AF PROJ. 7755 ................................................. p 111 N91-17541
AF-ARDCR-0437-89 ........................................... p 111 N91-17540
AF-PHI-078 .................................................... p 118 N91-18001
DA PROJ. 2Q2-63007-A-793 .................................. p 124 N91-17545
DE-AO2-76CH-00016 ........................................... p 123 N91-17544
DE-AO2-76AF-0099 ............................................ p 112 N91-18572
DE-AO26-76RL-01830 ........................................ p 111 N91-17537
DE-AO27-76ID-01570 .......................................... p 124 N91-17545
DE-FG02-86ER-13486 ......................................... p 105 N91-18570
DE-FG02-87ER-60519 ......................................... p 115 N91-18596
DE-FG02-87ER-60522 ......................................... p 105 N91-18568
DE-FG02-87ER-60539 ......................................... p 114 N91-18595
DE-FG02-86ER-60707 ......................................... p 115 N91-18598
DE-FG02-87ER-15769 ......................................... p 105 N91-18571
DE-FG06-86ER-12989 ......................................... p 105 N91-18571
EPA-SB-02-1105 .............................................. p 104 N91-17529
F3816L-67-D-0609 ............................................ p 111 N91-17541
MDA903-38-C-0031 ........................................... p 126 N91-18502
MDA903-84-C-0031 ........................................... p 111 N91-17535
MDA903-87-C-0523 ........................................... p 124 N91-17545
MOESC-6187002 .............................................. p 103 A91-26800
MOESC-62700114 ............................................. p 103 A91-26600
NAG-1092 ..................................................... p 120 A91-26832
NAG2-186 ..................................................... p 111 N91-17538
NAG2-340 ..................................................... p 103 A91-24780
NAG3-295 ..................................................... p 108 A91-27963
NAS9-17439 ................................................... p 110 A91-28163
NCC2-220 ..................................................... p 110 A91-28164
NGT-01-002-099 .............................................. p 104 A91-27964
NIH-AH-26710 ................................................ p 126 N91-10014
NIH-AM-35593 ............................................... p 106 A91-27965
NIH-EY-06717 ............................................... p 110 A91-28163
NIH-MC-12913 ............................................... p 103 A91-24781
NIH-HL-14885 ............................................... p 107 A91-26658
NIH-2-R4-A-AG-6957-02 ...................................... p 108 A91-27965
NOAA-NA-81AAD00027 ........................................ p 107 A91-25560
NSF PCM-83-15900 .......................................... p 103 A91-24781
N00014-85-K-0124 ........................................... p 123 N91-17543
N00014-85-K-0180 ........................................... p 123 N91-17543
PHS-EY-00288 ............................................... p 110 A91-28184
PHS-EY-06717 ............................................... p 110 A91-28184
W-31-109-ENG-36 ......................................... p 105 N91-18599
W-7405-ENG-38 .............................................. p 115 N91-18600
## Typical Report Number Index Listing

<table>
<thead>
<tr>
<th>REPORT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>ON MICROPICHE</th>
<th>PAGE NUMBER</th>
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- AAS PAPER 90-002 p 120 N91-26832
- AAS PAPER 90-003 p 120 N91-26833 *
- AAS PAPER 90-004 p 120 N91-26834 *
- AAS PAPER 90-005 p 121 N91-26835 *
- AAS PAPER 90-006 p 121 N91-26836 *
- AAS PAPER 90-007 p 121 N91-26837 *
- AAS PAPER 90-054 p 120 N91-26825 *
- AD-A224757 p 123 N91-17542 #
- AD-A226518 p 126 N91-17602 #
- AD-A227051 p 100 N91-17533 #
- AD-A229390 p 110 N91-17534 #
- AD-A229862 p 111 N91-17535 #
- AD-A229890 p 123 N91-17543 #
- AD-A229847 p 124 N91-17545 #
- AD-A2991030 p 111 N91-17539 #
- AD-A229911 p 111 N91-17540 #
- AD-A229237 p 111 N91-17541 #
- AD-E501304 p 111 N91-17535 #
- APHRL-TP-90-57 p 123 N91-17542 #
- APIT/CI/CIA-90-097 p 110 N91-17533 #
- AFOSR-90-1132TR p 111 N91-17540 #
- AI-TR-1234 p 123 N91-17543 #
- ARI-RN-90-78 p 126 N91-18020 #
- ARI-RN-91-01-VOL-2 p 124 N91-17545 #
- ASI90-329-90-II-VOL-2 p 124 N91-17545 #
- BNL-NUREG-45454 p 123 N91-17544 #
- CONF-901290-2 p 114 N91-18594 #
- CONF-9003229-2 p 105 N91-18569 #
- CONF-9006308-1 p 115 N91-18597 #
- CONF-9007910-1 p 115 N91-18600 #
- CONF-9007331-1 p 114 N91-18594 #
- CONF-900993-1 p 114 N91-18527 #
- CONF-9010155-4 p 124 N91-17548 #
- CONF-9010185-16 p 123 N91-17544 #
- CONF-9010265-1 p 111 N91-17537 #
- DE91-004782 p 115 N91-18596 #
- DE91-004807 p 111 N91-17537 #
- DE91-004824 p 115 N91-18600 #
- DE91-004949 p 126 N91-18604 #
- DE91-005086 p 114 N91-18594 #
- DE91-005130 p 105 N91-18598 #
- DE91-005386 p 112 N91-18572 #
- DE91-005439 p 123 N91-17544 #
- DE91-005979 p 114 N91-18595 #

DE91-006091 p 105 N91-18569 #
DE91-006150 p 124 N91-17546 #
DE91-006249 p 115 N91-18597 #
DE91-006251 p 115 N91-18598 #
DE91-006542 p 105 N91-18570 #
DE91-006619 p 105 N91-18571 #
DCE/EER-13466/5 p 105 N91-18570 #
DCE/EER-13488/2 p 105 N91-18571 #
DCE/EER-60519/T2 p 115 N91-18596 #
DCE/EER-60519/T4 p 105 N91-18566 #
DCE/EER-60597/T1 p 115 N91-18598 #

EGG-M-89066 p 124 N91-17546 #
EPA/600/D-90/144 p 104 N91-17530 #
EPA/600/1-90/003 p 104 N91-17526 #
ETH-N-98313 p 118 N91-18601
ETH-N-98366 p 105 N91-17532 #
ETH-N-98307 p 115 N91-18599 #
ETH-N-98698 p 126 N91-18605 #
ETH-N-98699 p 126 N91-18606 #
IDA-P-2379 p 111 N91-17535 #
IDA/HQ-90-35201 p 111 N91-17535 #
IIF-1990-A-18 p 118 N91-18601
JPR-ULS-90-014 p 113 N91-18583 #
JPR-ULS-90-015 p 113 N91-18579 #
JPR-ULS-90-016 p 112 N91-18574 #
LA-JR-90-3733 p 115 N91-18600 #
LCL-20441 p 112 N91-18572 #
NAS-1.28-187877 p 111 N91-17538 #
NAS-1.55-2108 p 112 N91-18573 #
NAS-1.51/MSC-21662-1 p 104 N91-17531 #
NAS-1.84/117 p 126 N91-18603 #
NASA-CASE-MSC-21662-1 p 104 N91-17531 #

DOE/ER-13486/5 p 105 N91-18570 #
DOE/ER-13488/2 p 105 N91-18571 #
DOE/EER-60519/T2 p 115 N91-18596 #
DOE/EER-60519/T4 p 105 N91-18566 #
DOE/EER-60597/T1 p 115 N91-18598 #

NASA-CASE-MSC-21662-1 p 104 N91-17531 #

NASA/CR-186612 p 109 N91-17530 #
NASA/CR-186612 p 109 N91-17529 #
NASA/CR-186612 p 109 N91-17526 #
NASA-PED-117 p 126 N91-18603 #
NBDL-90805 p 111 N91-17539 #

NISTIR-4371 p 111 N91-17536 #
NMRI-90-87 p 110 N91-17534 #
PBB-90-265150 p 104 N91-17529 #
PBB-90-265963 p 104 N91-17530 #
PBB-90-265970 p 111 N91-17536 #

PNL-SA-17594 p 114 N91-18584 #
PNL-SA-18664 p 112 N91-18537 #

REPT-89-02-RDL p 126 N91-18666 #
S-619 p 112 N91-18573 #
TD-90-1608 p 118 N91-18601
UCRL-ID-105261 p 126 N91-18604 #
UCRL-JC-105825 p 115 N91-18597 #

US-PATENT-APPL-SN-625345 p 104 N91-17531 #
USAFSAM-TR-90-28 p 111 N91-17541 #
ACCESSION NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 350)  
June 1991

Typical Accession Number Index Listing

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<thead>
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<th>ACCESSION NUMBER</th>
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A91-24320     #  p 115  A91-27697     p 122
A91-24322     #  p 116  A91-27698     p 122
A91-24322     #  p 118  A91-27707     *  p 108
A91-24780     *  p 103  A91-27708     p 122
A91-24781     *  p 103  A91-27712     *  p 122
A91-24784     *  p 103  A91-27713     *  p 122
A91-25100     p 116  A91-27717     p 122
A91-25210     p 106  A91-27727     p 122
A91-25250     p 106  A91-27826     *  p 117
A91-25265     p 106  A91-27862     p 108
A91-25297     p 103  A91-27963     p 108
A91-25329     *  p 103  A91-27964     *  p 104
A91-25320     p 106  A91-27966     p 108
A91-25845     p 118  A91-27967     *  p 118
A91-25532     p 103  A91-27969     *  p 109
A91-25555     p 106  A91-27970     *  p 109
A91-25656     p 107  A91-27971     p 109
A91-25657     p 107  A91-27972     p 109
A91-26558     p 107  A91-27976     *  p 109
A91-26559     p 107  A91-27977     *  p 109
A91-26560     p 107  A91-27978     *  p 109
A91-26605     *  p 116  A91-27979     *  p 109
A91-26606     p 116  A91-27980     *  p 109
A91-26621     p 119  A91-28156     *  p 104
A91-26622     p 119  A91-28158     *  p 104
A91-26623     p 119  A91-28163     *  p 110
A91-26733     p 119  A91-28164     *  p 110
A91-26764     p 119  A91-28169     *  p 117
A91-26765     p 119  A91-28170     *  p 110
A91-26766     p 119  A91-28175     *  p 110
A91-26767     p 120  A91-17044     *  p 117
A91-26768     p 120  A91-17048     *  p 113
A91-26769     p 116  A91-17520     #  p 104
A91-26791     p 120  A91-17530     #  p 104
A91-26792     p 116  A91-17531     *  p 104
A91-26793     p 116  A91-17532     #  p 105
A91-26794     p 116  A91-17533     #  p 110
A91-26795     p 116  A91-17534     #  p 110
A91-26796     p 117  A91-17535     #  p 111
A91-26797     p 107  A91-17536     #  p 111
A91-26800     #  p 103  A91-17537     #  p 111
A91-26825     *  p 120  A91-17538     #  p 111
A91-26832     p 120  A91-17529     #  p 111
A91-26833     *  p 120  A91-17540     #  p 111
A91-26834     *  p 120  A91-17541     #  p 111
A91-26835     *  p 121  A91-17542     #  p 123
A91-26836     *  p 121  A91-17543     #  p 123
A91-26837     *  p 121  A91-17544     #  p 123
A91-26845     #  p 104  A91-17545     #  p 124
A91-26846     #  p 108  A91-17546     #  p 124
A91-26903     p 121  A91-18077     #  p 124
A91-26926     p 121  A91-18078     #  p 124
A91-27694     p 121  A91-18127     #  p 124
A91-27695     *  p 121  A91-18128     #  p 125
A91-27696     p 122  A91-18137     #  p 125
A91-18150     *  p 125
A91-18548     *  p 125
A91-18568     #  p 105
A91-18569     #  p 105
A91-18570     #  p 105
A91-18571     #  p 105
A91-18572     #  p 112
A91-18573     #  p 112
A91-18574     #  p 112
A91-18575     #  p 112
A91-18576     #  p 112
A91-18577     #  p 117
A91-18578     #  p 112
A91-18579     #  p 113
A91-18580     #  p 113
A91-18581     #  p 113
A91-18582     #  p 125
A91-18583     #  p 113
A91-18584     #  p 113
A91-18585     #  p 113
A91-18586     #  p 113
A91-18587     #  p 113
A91-18588     #  p 117
A91-18589     #  p 114
A91-18590     #  p 114
A91-18591     #  p 114
A91-18592     #  p 114
A91-18593     #  p 117
A91-18594     #  p 114
A91-18595     #  p 114
A91-18596     #  p 115
A91-18597     #  p 115
A91-18598     #  p 115
A91-18599     #  p 115
A91-18601     #  p 118
A91-18602     #  p 126
A91-18603     #  p 126
A91-18604     #  p 126
A91-18605     #  p 126
A91-18606     #  p 126
A91-18627     #  p 118
A91-18993     #  p 106
A91-19014     *  p 126
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<thead>
<tr>
<th>Address</th>
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<table>
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<tr>
<th>PRICE CODE</th>
<th>NORTH AMERICAN PRICE</th>
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### Schedule E

**EXCEPTION PRICE DOCUMENTS AND MICROFICHÉ**

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