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June 28, 1996

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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# Introduction

This issue of *Aerospace Medicine and Biology, A Continuing Bibliography with Indexes* (NASA SP-7011) lists 101 reports, articles, and other documents recently announced in the NASA STI Database.

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.

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**Author Index** **PA-1**

Selecting an index above will link you to that comprehensive listing.

## Appendix

Select **Appendix** for important information about NASA Scientific and Technical Information (STI) Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

# Typical Report Citation and Abstract

## ACCESSION NUMBER



- DOCUMENT ID NUMBER** → 19960021053; 96N24540 NASA Langley Research Center, Hampton, VA USA. ← **CORPORATE SOURCE**
- TITLE** → **An Extended Compact Tension Specimen for Fatigue Crack Propagation and Fracture**
- AUTHORS** → Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; ← **AUTHORS' AFFILIATION**
- PUBLICATION DATE** → Mar. 1996, pp. 16; In English
- CONTRACTS/GRANTS** → Contract(s)/Grant(s): RTOP 538-02-10-01
- REPORT NO.(S)** → Report No.(s): NASA-TM-110243; NAS 1.15:110243; No Copyright; Avail: CASI A03, Hardcopy; A01, Microfiche ← **AVAILABILITY AND PRICE CODE**
- ABSTRACT** → developed for fatigue and fracture testing. Documented herein are stress-intensity factor and compliance expressions for the EC(T) specimen.
- ABSTRACT AUTHOR** → Author
- SUBJECT TERMS** → *Crack Propagation; Stress Intensity Factors; Fatigue (Materials)*

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# AEROSPACE MEDICINE AND BIOLOGY

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*A Continuing Bibliography (Suppl. 416)*

JUNE 28, 1996

51  
LIFE SCIENCES

**19960015578**; 96N22386 Michigan Univ., Ann Arbor, MI USA

**Nutritional effects in high density chlorella vulgaris cultures**

Mandalam, Ramkumar, Michigan Univ., USA, pp. 199; In English; No Copyright; Avail: Univ. Microfilms Order No. DA9513423, Hardcopy, Microfiche

Photobioreactors (PBRs), capable of producing high density microalgal cultures are imperative for economical and effective utilization of microalgae and its products. The four major factors to be considered for the design of closed PBRs are light source and delivery, gas supply and exchange, nutrient supply, and removal of harmful secondary metabolites. The two latter issues, which are critical in obtaining high biomass concentrations, are addressed in this thesis. Specifically, this thesis addresses (i) the effects of the presence of conditioned medium on high-density cultures and (ii) the nutritional requirements of high density microalgal cultures. Conditioned medium (CM) from high density cultures obtained from PBRs were tested for cell cycle and inhibitory activity. Low initial cell density cultures in presence of CM showed an accumulation of cells with two and four DNA equivalents, signifying a blockage of cell-division. Further, the culture pH increased by four units due to the presence of a high concentration of bicarbonate in the CM. Adding similar bicarbonate concentrations to fresh medium (FM) was found to increase the culture pH in an analogous fashion to CM cultures, causing blockage of cell division. The bicarbonate-free CM cultures at low (0.03%) CO<sub>2</sub> levels did not show any unusual cell cycle effects. CM cultures at high (5%) CO<sub>2</sub> levels supplemented with 100% FM components did not show any difference in growth and DNA content per cell distribution compared to 100% FM cultures. Further, experiments showed that there were no factors in the CM which were specific to cells in high density cultures. Taken together, these results lead to the conclusion that CM from high density cultures do not contain autoinhibitory or cell cycle modulating compounds that affect *C. vulgaris* in PBRs. N-8 medium, commonly used for culturing *Chlorella*, was evaluated for its capacity to support high density cultures on the basis of the

elemental composition of *Chlorella*. It was found that the N-8 medium was depleted of iron, magnesium, sulfur and nitrogen at high cell densities. N-8 medium was redesigned to contain stoichiometrically balanced quantities of all the elements, to support a biomass concentration of 2% (v/v). Cultures in redesigned medium (named M-8 medium) showed significant enhancement in biomass production and chlorophyll content. The viability of the cultures increased two-three times and the medium demonstrated the capacity to sustain long-term high density viable microalgal cultures. Thus, high density *C. vulgaris* cultures can be achieved in PBRs with the use of proper medium and without performing ultrafiltration. This thesis underlines the significance of nutritional effects in high cell density cultures and the importance of medium development in the enhancement of PBR performance.

Dissert. Abstr.

*Chlorella; Nutritional Requirements; Culture Techniques; Metabolites; Bioreactors*

**19960015587**; 96N22395 Dalhousie Univ., Halifax, Nova Scotia Canada

**Absorption properties of phytoplankton and photosynthetic pigments in seawater**

Hoepffner, Nicolas, Dalhousie Univ., Canada, pp. 157; In English; ISBN-0-315-93674-6; No Copyright; Avail: Univ. Microfilms Order No. DANN93674, Hardcopy, Microfiche

The vertical structure in fluorescence and beam attenuation (at 660 nm) is related to local hydrographic features and the composition of photosynthetic pigments for the western North Atlantic in September. Phytoplankton and covarying material appear to be the major factors affecting the beam attenuation coefficient through changes in species composition and pigment concentration, and through photoadaptation. Detailed pigment analysis combined with measurements of *in vivo* phytoplankton absorption spectra showed a major regional difference in the specific absorption spectra of phytoplankton which is directly linked to the structure of the phytoplankton community present in the water column. The results indicate a strong influence of other pigments co-existing with chlorophyll-alpha in algal cells on the variabilities of the specific-absorption coefficient of phytoplankton. To account for an effect due to pigment composition, absorption spectra of several phytoplankton species were decomposed, after

correction for the 'particle-size' effect, and the in vivo absorption properties of the major light-harvesting pigments were estimated. A Gaussian shape is suitable, theoretically and empirically, to represent the absorption spectra of individual photosynthetic components. The Gaussian parameters agreed well with the expected pigment compositions of 3 groups of algae, and the peak heights were linearly correlated with the concentrations of the 4 major pigments measured in the samples. The linear relationship did not vary with phytoplankton species. The results give estimates of the in vivo specific absorption coefficients of photosynthetic pigments which, then, are used to reconstruct the in vivo absorption spectrum of a multi-species samples. Another application of the previous results is to compute photosynthetic pigment concentrations in seawater from the knowledge of the absorption coefficient of phytoplankton. The contributions due to detrital particles and phytoplankton to total light absorption are retrieved by nonlinear regression on the absorption spectra of total particles from various oceanic regions. The model used explains more than 96% of the variance in the observed particle absorption spectra. The resulting absorption spectra of phytoplankton are then decomposed into Gaussian bands, following a similar procedure as the one previously described. Such a decomposition, combined with HPLC data of phytoplankton pigment concentrations, allows the computation of specific absorption coefficients for chlorophylls-a, -b, -c, and carotenoids. It is shown that these coefficients can be used to reconstruct the absorption spectra of phytoplankton at various locations and depths. Discrepancies that do occur at some stations are explained in terms of particle-size effect. Lastly, these coefficients can also be used to determine the concentrations of phytoplankton pigments in the water, knowing just the absorption spectrum of light by total particulate matter.

Dissert. Abstr.

*Absorption Spectra; Chlorophylls; Phytoplankton; Sea Water; Pigments; Spectroscopic Analysis*

**19960016388**; 96N22193 NASA Marshall Space Flight Center, Huntsville, AL USA

**Three-dimensional structure of Schistosoma japonicum glutathione S-transferase fused with a six-amino acid conserved neutralizing epitope of gp41 from HIV**

Lim, Kap, NASA Marshall Space Flight Center, USA; Ho, Joseph X., NASA Marshall Space Flight Center, USA; Keeling, Kim, NASA Marshall Space Flight Center, USA; Gilliland, Gary L., Center for Advanced Research in Biotechnology, USA; Ji, Xinhua, Center for Advanced Research in Biotechnology, USA; Rueker, Florian, Bodenkultur Univ., Austria; Carter, Daniel C., NASA Marshall Space Flight Center, USA, pp. 12; In English; Original contains 2 color illustrations

Report No.(s): NASA-CR-200319; NAS 1.26:200319; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 3-dimensional crystal structure of glutathione S-transferase (GST) of *Schistosoma japonicum* (Sj) fused with a conserved neutralizing epitope on gp41 (glycoprotein, 41 kDa) of human immunodeficiency virus type 1 (HIV-1) was determined at 2.5 Å resolution. The structure of the 3-3 isozyme rat GST of the mu gene class was used as a molecular replacement model. The structure consists of a 4-stranded beta-sheet and 3 alpha-helices in domain 1 and 5 alpha-helices in domain 2. The space group of the Sj GST crystal is P4(sub 3)2(sub 1)2 with unit cell dimensions of a = b = 94.7 Å, and c = 58.1 Å. The crystal has 1 GST monomer per asymmetric unit, and 2 monomers that form an active dimer are related by crystallographic 2-fold symmetry. In the binding site, the ordered structure of reduced glutathione is observed. The gp41 peptide (Glu-Leu-Asp-Lys-Trp-Ala) fused to the C-terminus of Sj GST forms a loop stabilized by symmetry-related GSTs. The Sj GST structure is compared with previously determined GST structures of mammalian gene classes mu, alpha, and pi. Conserved amino acid residues among the 4 GSTs that are important for hydrophobic and hydrophilic interactions for dimer association and glutathione binding are discussed.

Author

*Human Immunodeficiency Virus; Crystal Structure; Amino Acids; Three Dimensional Models; Glutathione; Molecular Structure*

**19960016575**; 96N22219 Salk Inst. for Biological Studies, San Diego, CA USA

**Unnatural selection in chemical systems**

Orgel, Leslie E., Salk Inst. for Biological Studies, USA; ISSN 0128-0109, pp. 10; In English

Contract(s)/Grant(s): NAGw-2881

Report No.(s): NASA-CR-200316; NAS 1.26:200316; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The theory of evolution through natural selection was proposed by Darwin and Wallace to explain how the characteristics of populations of animals change with time. An examination of their assumptions shows that the theory has much broader application than they originally envisaged. We now know that in appropriate environments RNA molecules or computer viruses, for example, can evolve. The adventure with which we are concerned is the quest for chemical systems that undergo processes analogous to Darwinian selection in the test tube. The search is not restricted to systems that are closely related to nucleic acids, although most of the available experimental evidence concerns such systems. A population of molecules satisfies all the requirements of the theory if there are different kinds of molecules in the population and if each individual molecule can direct the formation of copies of itself, then a population of molecules will adapt to a varying environment by changing its composition so as to maintain as high as possible a rate of replication. Sol Spiegelman is the inventor of 'unnatural selection'. He showed clearly that pop-

ulations of RNA molecules evolve when replicated repeatedly by Q beta RNA polymerase under a chosen set of adverse reaction conditions. In the systems that he studied, the initial population was fairly homogeneous and much of the variation was created during the course of the experiment by mutation, that is, error of replication. The term 'unnatural selection' will be used loosely to describe evolution of nucleic acids or other replicatable polymers in vitro. The term 'Natural Selection' will be reserved for the evolution of living organisms and their viruses. Natural Selection usually involves the coevolution of nucleic acids and proteins, while 'unnatural selection', as practiced so far, allows replicating nucleic acids to evolve but hold constant the enzymes that catalyze replication. It is widely believed that biology based on DNA, RNA, and proteins was preceded by the biology of an 'RNA world' in which enzymes were composed of RNA alone. The origin of RNA replication is thus the central puzzle of the origins of life. Consequently, RNA-catalyzed RNA replication is presently one of the main goals of experimental work on unnatural selection. However, there is also a more distant goal, namely, to achieve replication and selection in systems unrelated to RNA. These different systems are discussed in this article.

Derived from text

*Biological Evolution; Enzymes; Polymer Chemistry; Copolymers; Nucleotides; Peptides; Molecular Physics; Assessments; Chemical Evolution*

**19960016635**; 96N22268 Georgia State Univ., Language Research Center, Atlanta, GA USA

**Selection of behavioral tasks and development of software for evaluation of Rhesus Monkey behavior during space-flight** *Semiannual Report, Mar. - Aug. 1995*

Rumbaugh, Duane M., Georgia State Univ., USA; Washburn, David A., Georgia State Univ., USA; Richardson, W. K., Georgia State Univ., USA; 1995, pp. 10; In English  
Contract(s)/Grant(s): NAG2-438

Report No.(s): NASA-CR-200192; NAS 1.26:200192; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The results of several experiments were disseminated during this semiannual period. This publication and each of these presented papers represent investigations of the continuity in psychological processes between monkeys and humans. Thus, each serves to support the animal model of behavior and performance research.

Derived from text

*Performance Prediction; Monkeys*

**19960016647**; 96N22272 NASA Ames Research Center, Moffett Field, CA USA

**Space Station Biological Research Project: Reference Experiment Book**

Johnson, Catherine, Editor, NASA Ames Research Center,

USA; Wade, Charles, Editor, NASA Ames Research Center, USA; Jan. 1996, pp. 548; In English

Contract(s)/Grant(s): RTOP 947-30-60

Report No.(s): NASA-TM-110378; A-960965; NAS 1.15:110378; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

The Space Station Biological Research Project (SSBRP), which is the combined efforts of the Centrifuge Facility (CF) and the Gravitational Biology Facility (GBF), is responsible for the development of life sciences hardware to be used on the International Space Station to support cell, developmental, and plant biology research. The SSBRP Reference Experiment Book was developed to use as a tool for guiding this development effort. The reference experiments characterize the research interests of the international scientific community and serve to identify the hardware capabilities and support equipment needed to support such research. The reference experiments also serve as a tool for understanding the operational aspects of conducting research on board the Space Station. This material was generated by the science community by way of their responses to reference experiment solicitation packages sent to them by SSBRP scientists. The solicitation process was executed in two phases. The first phase was completed in February of 1992 and the second phase completed in November of 1995. Representing these phases, the document is subdivided into a Section 1 and a Section 2. The reference experiments contained in this document are only representative microgravity experiments. They are not intended to define actual flight experiments. Ground and flight experiments will be selected through the formal NASA Research Announcement (NRA) and Announcement of Opportunity (AO) experiment solicitation, review, and selection process.

Author

*Cells (Biology); International Space Station; Plants (Botany); Gravitational Effects; Spaceborne Experiments; Microgravity*

**19960016663**; 96N22281 Georgia State Univ., Language Research Center., Atlanta, GA USA

**Selection of behavioral tasks and development of software for evaluation of Rhesus Monkey behavior during space-flight** *Annual Report, 1 Feb. 1995 - 31 Jan. 1996*

Rumbaugh, Duane M., Georgia State Univ., USA; Washburn, David A., Georgia State Univ., USA; Richardson, W. K., Georgia State Univ., USA, pp. 12; In English  
Contract(s)/Grant(s): NAG2-438

Report No.(s): NASA-CR-200201; NAS 1.26:200201; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of several experiments were disseminated during this semiannual period. These publications and presented papers represent investigations of the continuity in psychological processes between monkeys and humans.

Thus, each serves to support the animal model of behavior and performance research.

Derived from text

*Monkeys; Performance Prediction*

**19960016702**; 96N22299 California Univ., Environmental Physiology Lab., Davis, CA USA

**Squirrel Monkey Requirements for Chronic Acceleration Final Report**

Fuller, Charles A., California Univ., USA; [1996], pp. 27; In English

Contract(s)/Grant(s): NAG2-467

Report No.(s): NASA-CR-200686; NAS 1.26:200686; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examined: (1) the ability of a small non-human primate to tolerate chronic centrifugation on a centrifuge with a radius of 0.9 m, and (2) the influence of centrifuge radius on the response of primates to hyperdynamic fields. Eight adult male squirrel monkeys were exposed to 1.5 g via centrifugation at two different radii (0.9 m and 3.0 m). Body temperature, activity, feeding and drinking were monitored. These primates did tolerate and adapt to 1.5G via centrifugation on either radius centrifuge. The results show, however, that centrifuge radius does have an effect on the responses of the primate to the hyperdynamic environment. Adaptation to the hyperdynamic environment occurred more quickly on the larger centrifuge. This study demonstrates that a small, non-human primate model, such as the squirrel monkey, could be used on a 0.9 m radius centrifuge such as is being considered by the NASA Space Station Program.

Author

*Centrifuges; High Gravity Environments; Activity (Biology); Radii; Physiological Tests; Gravitational Effects; Physiological Acceleration*

**19960016974**; 96N22580 NASA Ames Research Center, Moffett Field, CA USA

**Interactive effects of growth hormone and exercise on muscle mass in suspended rats**

Grindeland, Richard E., NASA Ames Research Center, USA; Roy, Roland R., NASA Ames Research Center, USA; Edger-ton, V. Reggie, NASA Ames Research Center, USA; Gros-sman, Elena J., NASA Ames Research Center, USA; Mukku, Venkat R., NASA Ames Research Center, USA; Jiang, Bian, NASA Ames Research Center, USA; Pierotti, David J., NASA Ames Research Center, USA; Rudolph, Ingrid, NASA Ames Research Center, USA; 1994, pp. 8; Repr. from Am. J. Physiol., v. 267, n. 36, 1994 p 316-322; In English

Contract(s)/Grant(s): 199-26-12-09

Report No.(s): NASA-CR-200187; NAS 1.26:200187; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Measures to attenuate muscle atrophy in rats in response to simulated microgravity (hindlimb suspension (HS)) have been only partially successful. In the present study, hypophy-

sectomized rats were in HS for 7 days, and the effects of recombinant human growth hormone (GH), exercise (Ex), or GH+Ex on the weights, protein concentrations, and fiber cross-sectional areas (CSAs) of hindlimb muscles were determined. The weights of four extensor muscles, i.e., the soleus (Sol), medial (MG) and lateral (LG) gastrocnemius, and plan-taris (Plt), and one adductor, i.e., the adductor longus (AL), were decreased by 10-22% after HS. Fiber CSAs were decreased by 34% in the Sol and by 17% in the MG after HS. In contrast, two flexors, i.e., the tibialis anterior (TA) and extensor digitorum longus (EDL), did not atrophy. In HS rats, GH treatment alone maintained the weights of the fast extensors (MG, LG, Plt) and flexors (TA, EDL) at or above those of control rats. This effect was not observed in the slow extensor (Sol) or AL. Exercise had no significant effect on the weight of any muscle in HS rats. A combination of GH and Ex treatments yielded a significant increase in the weights of the fast extensors and in the CSA of both fast and slow fibers of the MG and significantly increased Sol weight and CSA of the slow fibers of the Sol. The AL was not responsive to either GH or Ex treatments. Protein concentrations of the Sol and MG were higher only in the Sol of Ex and GH+Ex rats. These results suggest that while GH treatment or intermittent high intensity exercise alone have a minimal effect in maintaining the mass of unloaded muscle, there is a strong interactive effect of these two treatments.

Author

*Rats; Muscles; Growth*

**19960017279**; 96N22870 Research and Development Association for Future Electron Devices, Tokyo, Tokyo, Japan

**An Introduction to the Bioelectronic Devices Project**

Watsuji, Toru, Research and Development Association for Future Electron Devices, Tokyo, Japan; Ikeda, Akira, Re-search and Development Association for Future Electron Devices, Tokyo, Japan; 1995, pp. 5; In English; 14th Sym-posium of Future Electron Devices, 17-18 Oct. 1995, Tokyo, Ja-pan; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The theme of the Bioelectronic Devices Project is the development of artificial bioelectronic devices by elucidating the basic principles controlling the operation and memory function of neural cell systems and by establishing the technology to control molecular assemblies possessing unique characteristics such as plasticity, computational power, and multiple input/output. Prototype devices have been developed and are now being evaluated. The outline of this project is given along with the latest experimental results.

Author (revised)

*Bionics; Memory (Computers); Information Processing (Biology); Molecular Electronics; Neural Nets; Bioelectric-ity; Artificial Intelligence*

**19960017308**; 96N22899 Armstrong Lab., Brooks AFB, TX USA

**Evaluation of Flow Biosensor Technology in a Chronically-Instrumented Non-Human Primate Model**

Koenig, S. C., Armstrong Lab., USA; Reister, C., Armstrong Lab., USA; Schaub, J., Armstrong Lab., USA; Muniz, G., Armstrong Lab., USA; Ferguson, T., Armstrong Lab., USA; Fanton, J. W., Armstrong Lab., USA; Sep. 1995, pp. 5  
Report No.(s): AD-A300623; AL/AO-PC-1995-0057; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Physiology Research Branch of Brooks AFB conducts both human and non-human primate experiments to determine the effects of microgravity and hypergravity on the cardiovascular system and to identify the particular mechanisms that invoke these responses. Primary investigative research efforts in a non-human primate model require the calculation of total peripheral resistance (TPR), systemic arterial compliance (SAC), and pressure-volume loop characteristics. These calculations require beat-to-beat measurement of aortic flow. We have evaluated commercially available electromagnetic (EMF) and transit-time flow measurement techniques. In vivo and in vitro experiments demonstrated that the average error of these techniques is less than 25 percent for EMF and less than 10 percent for transit-time.

DTIC

*Bioinstrumentation; Blood Flow; Flow Measurement; Performance Tests*

**19960017309**; 96N22900 Armstrong Lab., Clinical Sciences Div., Brooks AFB, TX USA

**Cardiac Pacing in a Chronically Instrumented Non-Human Primate Model during Centrifugation,**

Reister, Craig, Armstrong Lab., USA; Muniz, Gary, Armstrong Lab., USA; Ferguson, Tim, Armstrong Lab., USA; Drew, Guy, Armstrong Lab., USA; Fanton, John, Armstrong Lab., USA; Sep. 1995, pp. 4; In English

Contract(s)/Grant(s): AFOSR-2312W703; AF Proj. 2312  
Report No.(s): AD-A300621; AL/AO-PC-1995-0056; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Physiology Research Branch has developed a chronically instrumented non-human primate model for evaluating cardiac function during exposure to altered gravitational environments. This model has been used to measure cardiovascular hemodynamics and electrical activity. We have expanded the model to include cardiac pacing for evaluation of responses and mechanisms in normal and dysrhythmic states. In particular, we have been able to produce constant rates by means of atrial, ventricular, and dual chamber pacing during centrifugation. Preventricular contractions, bigeminal, and trigeminal rhythms have also been invoked using this same pacing model.

DTIC

*Cardiovascular System; Centrifuging; Heart Function;*

*Hemodynamics; Blood Circulation; Microgravity; Aerospace Medicine; Models; Physiological Responses*

**19960017607**; 96N23165 NASA Marshall Space Flight Center, Huntsville, AL USA

**Computerized In Vitro Test for Chemical Toxicity Based on Tetrahymena Swimming Patterns**

Noever, David A., NASA Marshall Space Flight Center, USA; Matsos, Helen C., NASA Marshall Space Flight Center, USA; Cronise, Raymond J., NASA Marshall Space Flight Center, USA; Looger, Loren L., NASA Marshall Space Flight Center, USA; Relwani, Rachna A., NASA Marshall Space Flight Center, USA; Johnson, Jacqueline U., Alabama A & M Univ., USA; 1994; ISSN 0045-6535, pp. 12; Repr. from *Chemosphere* (Barking, UK, Elsevier Science Ltd.) v. 29, no. 6 1994 p 1373-1384; In English; Second International Conference on Environmental and Industrial Toxicology, 9-12 Dec. 1996, Bangkok, Thailand

Report No.(s): NASA-TM-111408; NAS 1.15:111408; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

An apparatus and a method for rapidly determining chemical toxicity have been evaluated as an alternative to the rabbit eye irritancy test (Draize). The toxicity monitor includes an automated scoring of how motile biological cells (*Tetrahymena pyriformis*) slow down or otherwise change their swimming patterns in a hostile chemical environment. The method, called the motility assay (MA), is tested for 30 s to determine the chemical toxicity in 20 aqueous samples containing trace organics and salts. With equal or better detection limits, results compare favorably to in vivo animal tests of eye irritancy.

Author

*Bioassay; Toxicity; Protozoa; Chemical Effects; Biological Effects; Image Analysis*

**19960017625**; 96N23181 Illinois Univ., Bioenvironmental Engineering Research Lab., Urbana, IL USA

**Effect of Diet on Metabolism of Laboratory Rats Final Report**

Harrison, P. C., Illinois Univ., USA; Riskowski, G. L., Illinois Univ., USA; McKee, J. S., Illinois Univ., USA; Mar. 1996, pp. 102; In English

Contract(s)/Grant(s): NAG2-863

Report No.(s): NASA-CR-200762; NAS 1.26:200762; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In previous studies when rats were fed a processed, semi-purified, extruded rodent food bar (RFB) developed for space science research, we noted a difference in the appearance of gastrointestinal tissue (GI); therefore the following study evaluated GI characteristics and growth and metabolic rates of rats fed chow (C) or RFB. Two hundred and twenty-four rats (78 g mean body weight) were randomly assigned to 28 cages and provided C or RFB. Each cage was considered the

experimental unit and a 95 percent level of significance, indicated by ANOVA, was used for inference. After each 30-, 60-, and 90-day period, eight cages were shifted from the C to RFB diet and housing density was reduced by two rats per cage. The two rats removed from each cage were sacrificed and used for GI evaluation. Metabolic rates of the rats in each cage were determined by indirect calorimetry. No differences in body weight were detected at 0, 30, 60 or 90 days between C and RFB. Heat production (kcal/hr/kg), CO<sub>2</sub> production (L/hr/kg) and O<sub>2</sub> consumption (L/hr/kg) were different by light:dark and age with no effect of diet. Respiratory quotient was different by age with no effect of light:dark or diet. Rats on the C diet ate less food and drank more water than those on RFB. C rats produced more fecal and waste materials than the RFB. GI lengths increased with age but were less in RFB than C. GI full and empty weights increased with age but weighed less in RFB than C. Gut-associated lymphoid tissue (GALT) numbers increased with age with no effect of diet. No differences in ileum-associated GALT area were detected between C and RFB. Switching C to RFB decreased GI length, GI full and empty weights, with no changes in GALT number or area. We concluded RFB decreased GI mass without affecting metabolic rate or general body growth.

Author

*Diets; Metabolism; Gastrointestinal System; Body Weight; Tissues (Biology)*

**19960017729**; 96N23260 NASA Johnson Space Center, Houston, TX USA

**Plant Condition Remote Monitoring Technique**

Fotedar, L. K., Texas Univ., USA; Krishen, K., NASA Johnson Space Center, USA; Jan. 1996, pp. 8; In English; Proceedings of the IEEE International Geoscience and Remote Sensing Symposium (IGARSS 1996), 27- 31 May 1996, Lincoln, NE, USA

Report No.(s): NASA-TM-111409; NAS 1.15:111409; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper summarizes the results of a radiation transfer study conducted on houseplants using controlled environmental conditions. These conditions included: (1) air and soil temperature; (2) incident and reflected radiation; and (3) soil moisture. The reflectance, transmittance, and emittance measurements were conducted in six spectral bands: microwave, red, yellow, green, violet and infrared, over a period of three years. Measurements were taken on both healthy and diseased plants. The data was collected on plants under various conditions which included: variation in plant bio-mass, diurnal variation, changes in plant pathological conditions (including changes in water content), different plant types, various disease types, and incident light wavelength or color. Analysis of this data was performed to yield an algorithm for plant disease from the remotely sensed data.

Author

*Radiative Transfer; Plant Diseases; Reflectance; Transmittance; Remote Sensing; Reflected Waves; Emittance*

**19960017808**; 96N23335 NASA Ames Research Center, Moffett Field, CA USA

**Assessment of Leaf Area, Vine Vigor, and Grape Yield and Quality of Phylloxera-Infested and Non-Infested Grapevines in Napa County and Their Relationship to Leaf Reflectance, Chlorophyll, and Mineral Content *Final Report***

Baldy, Richard W., California State Univ., USA; Baldy, Marian W., California State Univ., USA; DeBenedictis, John A., California Univ., USA; Granett, Jeffrey, California Univ., USA; Osborn, Bryan P., California Univ., USA; Bledsoe, Andy, Mondavi (Robert) Winery, USA; Bosch, Daniel, Mondavi (Robert) Winery, USA; Hlavka, Christine, NASA Ames Research Center, USA; Johnson, Lee, NASA Ames Research Center, USA; Weber, Ed, Weber (Ed). Napa, USA, pp. 30; In English

Contract(s)/Grant(s): NCC2-5062

Report No.(s): NASA-CR-200627; NAS 1.26:200627; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Grape Phylloxera will cause the California wine industry to lose over one billion dollars by the year 2000. Grape growers with grape phylloxera- infested soils graft scion varieties onto what are popularly termed 'resistant rootstocks.' Rootstocks, however, differ in their suppression of phylloxera: some do not support the insect at all, while other support low populations. In addition, phylloxera biotypes vary in their growth on different rootstocks. In California's Napa and Sonoma county vineyards, about 75% of the vines have AXR#1 rootstock that tolerates phylloxera biotype A. In the early 1980's biotype B emerged there. It so devastates AXR#1 that the vineyards must be replanted with rootstocks resistant to biotypes A and B. Timing replanting is difficult because vineyards do not decline uniformly. A patchwork of uninfested vines, infested but asymptomatic vines, declining but productive vines', and unproductive vines typifies most vineyards. The grower must determine the proportion of vines in each category and estimate the yield loss the stressed vines will suffer. During 1993, 1994 and 1995 the NASA-Ames GRAPES study used remotely sensed leaf reflectance, temperature, and canopy size data and geographic information system (GIS) technology to study infestations in Napa County vineyards. As part of this study a vineyard with a range of phylloxera induced stress and accompanying symptoms -- reduced growth, less chlorophyll, and lower reflectance of near infrared:red light -- was investigated to determine the degree to which stress measurements predict the current and following season's yields from stressed vines relative to healthy vines. Such yield estimates could enable a grower -- before obtaining actual yields -- to calculate the economics of

replanting. A grower who decided to replant would have 2-14 months additional lead time to plan and prepare.

Author

*Vineyards; Infestation; Stress Measurement; Agriculture*

**19960017989**; 96N23421 Lawrence Livermore National Lab., Livermore, CA USA

**Chromosome translocations measured by fluorescence in-situ hybridization: A promising biomarker**

Lucas, Joe N., Lawrence Livermore National Lab., USA; Straume, Tore, Lawrence Livermore National Lab., USA; Oct. 1995, pp. 19; In English; 5th American Society for Testing Materials Symposium on Environmental Toxicology and Risk Assessment, 2 - 7 Apr. 1995, Denver, CO, USA

Contract(s)/Grant(s): W-7405-eng-48

Report No.(s): UCRL-JC-122206; CONF-9504216-1; DE96-002123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A biomarker for exposure and risk assessment would be most useful if it employs an endpoint that is highly quantitative, is stable with time, and is relevant to human risk. Recent advances in chromosome staining using fluorescence in situ hybridization (FISH) facilitate fast and reliable measurement of reciprocal translocations, a kind of DNA damage linked to both prior exposure and risk. In contrast to other biomarkers available, the frequency of reciprocal translocations in individuals exposed to whole-body radiation is stable with time post exposure, has a rather small inter-individual variability, and can be measured accurately at the low levels. Here, the authors discuss results from their studies demonstrating that chromosome painting can be used to reconstruct radiation dose for workers exposed within the dose limits, for individuals exposed a long time ago, and even for those who have been diagnosed with leukemia but not yet undergone therapy.

DOE

*Chromosomes; Radiation Effects; Radiation Damage; Biological Effects; Ionizing Radiation; Genetics*

**19960018476**; 96N23754 Jorge Scientific Corp., Greenbelt, MD USA

**Life and Biomedical Sciences and Applications Advisory Subcommittee Meeting**

Mar. 1996, pp. 40; In English; Life and Biomedical Sciences and Applications Advisory Subcommittee Meeting, 22-23 Aug. 1995, USA

Report No.(s): NSA-CP-3331; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The proceedings of the August 1995 meeting of the Life and Biomedical Sciences and Applications Advisory Subcommittee (LBSAAS) are summarized. The following topics were addressed by the Subcommittee members: the activities and status of the LBSA Division; program activities of the Office of Life and Microgravity Sciences and Applications (OLMSA); the medical Countermeasures Program; and the

Fettman Report on animal research activities at ARC. Also presented were a history and overview of the activities of the Space Station Utilization Advisory Committee and the Advanced Life Support Program (ALSP). The meeting agenda and a list of the Subcommittee members and meeting attendees are included as appendices.

Author

*Spaceborne Experiments; Life Sciences; Biomedical Data; Aerospace Medicine; Biological Effects; Conferences; Life Support Systems; Microgravity*

**19960020458**; 96N24030 Illinois Univ., Bioenvironmental Engineering Research Lab., Urbana, IL USA

**Effect of Diet on Metabolism of Laboratory Rats Final Report**

Harrison, P. C., Illinois Univ., USA; Riskowski, G. L., Illinois Univ., USA; McKee, J. S., Illinois Univ., USA; Mar. 1996, pp. 98; In English

Contract(s)/Grant(s): NAG2-863

Report No.(s): NASA-CR-200818; NAS 1.26:200818; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

In previous studies when rats were fed a processed, semi-purified, extruded rodent food bar (RFB) developed for Space Science research, we noted a difference in the appearance of gastrointestinal tissue (GI); therefore the following study evaluated GI characteristics and growth and metabolic rates of rats fed chow (C) or RFB. Two hundred and twenty-four rats (78 g mean body weight) were randomly assigned to 28 cages and provided C or RFB. Each cage was considered the experimental unit and a 95 percent level of significance, indicated by ANOVA, was used for inference. After each 30-, 60-, and 90-day period, eight cages were shifted from the C to RFB diet and housing density was reduced by two rats per cage. The two rats removed from each cage were sacrificed and used for GI evaluation. Metabolic rates of the rats in each cage were determined by indirect calorimetry. No differences in body weight were detected at 0, 30, 60 or 90 days between C and RFB. Heat production (kcal/hr/kg), CO<sub>2</sub> production (L/hr/kg) and O<sub>2</sub> consumption (L/hr/kg) were different by light:dark and age with no effect of diet. Respiratory quotient was different by age with no effect of light:dark or diet. Rats on the C diet ate less food and drank more water than those on RFB. C rats produced more fecal and waste materials than the RFB. GI lengths increased with age but were less in RFB than C. GI full and empty weights increased with age but weighed less in RFB than C. Gut-associated lymphoid tissue (GALT) numbers increased with age with no effect of diet. No differences in ileum-associated GALT area were detected between C and RFB. Switching C to RFB decreased GI length, GI full and empty weights, with no changes in GALT number or area. We concluded RFB decreased GI mass without affecting metabolic rate or general body growth.

Author

*Metabolism; Gastrointestinal System; Diets; Environmental*

*Control; Biological Effects; Physiological Effects; Tissues (Biology)*

**19960020462**; 96N24034 California Univ., Chronic Acceleration Research Unit and California Primate Research Center., Davis, CA USA

**Biological Rhythms and Temperature Regulation in Rhesus Monkeys During Spaceflight Final Report**

Fuller, Charles A., Principal Investigator, California Univ., USA; Jan. 1996, pp. 39; In English

Contract(s)/Grant(s): NAG2-587

Report No.(s): NASA-CR-200817; NAS 1.26:200817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This program examined the influence of microgravity on temperature regulation and circadian timekeeping systems in Rhesus monkeys. Animals flown on the Soviet Biosatellite COSMOS 2229 were exposed to 11 2/3 days of microgravity. The circadian patterns temperature regulation, heart rate and activity were monitored constantly. This experiment has extended previous observations from COSMOS 1514 and 2044, as well as provided insights into the physiological mechanisms that produce these changes.

Derived from text

*Circadian Rhythms; Body Temperature; Microgravity; Physiological Effects; Biological Effects; Spaceborne Experiments; Gravitational Effects; Activity (Biology)*

**19960020558**; 96N24107 Institute of Space Medico, Beijing, China

**Space Medicine and Medical Engineering, Volume 8 Hangtian Yixue Yuyixue Gongcheng**

Jinhe, Wei, Editor, Institute of Space Medico, China; Tiande, Yang, Editor, Institute of Space Medico, China; Jianfeng, Fan, Editor, Institute of Space Medico, China; Duansheng, Huang, Editor, Institute of Space Medico, China; Zheng, Xu, Editor, Institute of Space Medico, China; Yincheng, Lu, Editor, Institute of Space Medico, China; Xueqi, Yang, Editor, Institute of Space Medico, China; Zhijun, Xiao, Editor, Institute of Space Medico, China; Yong, Liu, Editor, Institute of Space Medico, China; Dec. 1995; ISSN 1002-0837, pp. 61; In Chinese; Also announced as 1996039533

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This journal includes articles on effects of simulated weightlessness and high concentration oxygen on lungs in rats; effects of simulated weightlessness on lungs in tail-suspended rats; protective effects of taponin against acute hypobaric hypoxia in rats; microbial experiments with space-microbial-cultivator on recoverable satellite; effects of simulated weightlessness and radiation on immune function and beta-endorphin production in the pituitary in rats; effects of simulated weightlessness on hemopoiesis and morphology of red blood cells in rabbits; possibility of application of capil-

lary pumped loop in a manned space cabin's thermal environment control; and possibility of application of the principles of differentiation and treatment of common syndromes of the traditional chinese medicine in manned space flight.

CASI

*Aerospace Environments; Aerospace Medicine; Lungs; Pituitary Gland; Weightlessness Simulation*

**19960020559**; 96N24108 Institute of Space Medico, Beijing, China

**Effects of simulated weightlessness and high concentration oxygen on lungs in rats**

Ruguo, Zhang, Institute of Space Medico, China; Chengmin, Wang, Institute of Space Medico, China; Hongwei, Fu, Institute of Space Medico, China; Space Medicine and Medical Engineering, Vol. 8, No. 4; Dec. 1995, pp. 235-238; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Experiments were conducted on 60 Wistar rats divided into 5 groups: control, high concentration oxygen ('high oxygen') exposure for 12 h, and for 36 h; tail-suspension plus high oxygen exposure for 12 h, and for 36 h. After high oxygen exposure for 12 h, inflammatory cell infiltrations of lung tissue was seen under microscopy. After exposure for 36h, endothelial endoplasmic reticulum of the cells were swollen and decreased in density; density of mitochondria increased and its structure could not be seen clearly. Suspension combined with high oxygen induced more severe edema in the lung than that induced by simple high oxygen exposure. There were different degrees of edema in the epithelium, endothelium, and basement membrane. Wet-to-dry weight ratio of lung tissue increased, but inflammatory reaction was milder than that in simple high oxygen exposure. Activity of angiotensin converting enzyme (ACE) tended to increase after exposure to the combined factors for 36 h. All of these changes indicated that the combined effect of these two factors aggravated the lung damage, so the toxic dose and safety exposure time of oxygen on the ground should be revised for weightlessness condition before using in space flight.

Author

*Weightlessness Simulation; Lungs; Oxygen; Gravitational Effects*

**19960020560**; 96N24109 Institute of Space Medico, Beijing, China

**Effects of simulated weightlessness on lungs in tail-suspended rats**

Chengmin, Wang, Institute of Space Medico, China; Ruguo, Zhang, Institute of Space Medico, China; Hongwei, Fu, Institute of Space Medico, China; Space Medicine and Medical Engineering, Vol. 8, No. 4; Dec. 1995, pp. 239-241; In Chinese; Also announced as 1996039533; No Copyright; Avail:

CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Experiments were conducted on 36 Wistar rats, divided into 3 groups: control, suspended for 5.5 d and for 6.5 d. Tail-suspension (-30 deg) was used as weightlessness simulation. The results demonstrated that pneumorrhagia was more severe in the anterior lobe and paralobe of the right lung, but the severity was not correlated with suspension time. Lung tissue changes were the same in rats suspended for 5.5 d and 6.5 d, capillaries were distended and filled with blood, some endothelial cells of the capillaries disrupted, and many red cells could be seen in the alveolar cavities. The wet-to-dry weight ratio of lungs was normal. The DL-2-phosphatidylcholine (DSBC) of the alveolar lavage was normal, but its surface tension increased. Edema of the lungs was not observed. It indicated that suspension influenced the function of surfactant of the lungs.

Author

*Weightlessness Simulation; Gravitational Effects; Lungs; Pulmonary Circulation*

**19960020561**; 96N24110 Institute of Space Medico, Beijing, China

**Protective effects of Taponin against acute hypobaric hypoxia in rats**

Qifu, Yu, Institute of Space Medico, China; Ye, Yang, Institute of Space Medico, China; Qingdi, Li, Institute of Space Medico, China; Yuntao, Zhao, Institute of Space Medico, China; Weiwei, Hao, Institute of Space Medico, China; Space Medicine and Medical Engineering, Vol. 8, No. 4; Dec. 1995, pp. 242-245; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Acute hypobaric hypoxia may produce many kinds of effects on the organism. We have found in early investigations that the amount of circulatory endothelial cells was increased, plasma endothelin content was greatly increased, and that ultrastructure of the myocardium, activities of myocardial enzymes and hepatic functions changed greatly after acute hypobaric hypoxia. All these facts suggested that there were important effects of acute hypobaric hypoxia on myocardium, liver and vascular endothelial cells. It was found that hypoxic state may cause significant production and release of platelet activating factor (PAF) in platelets, white cells and endothelial cells, which may result in damage of the various organs. In order to investigate the effect of PAF during acute hypobaric hypoxia, Taponin - a kind of natural anti-PAF substance was used in the experiment to observe its protection against the harmful effects of acute hypobaric hypoxia. The results showed that gastric irrigation with Taponin 0.5 g/kg for eight times had certain protective effects against the damage of myocardium, hepatic functions and endothelial cells caused by acute hypobaric hypoxia. The contents of CPK, LDH, alpha-HBD, AST, ALT, gamma-GT, and ET after hypoxia

were not significantly different from those in the control. This means that there is a certain relationship between PAF and the harmful effects of acute hypobaric hypoxia.

Author

*Protection; Hypoxia; Oxygen Consumption; Hypobaric Atmospheres*

**19960020562**; 96N24111 Institute of Space Medico, Beijing, China

**Preliminary report of microbial experiments with space-microbial-cultivator on recoverable satellite**

Zhihong, Zhou, Institute of Space Medico, China; Borun, Zhang, Institute of Space Medico, China; Shuzhen, Jiang, Institute of Space Medico, China; Qin, Li, Institute of Space Medico, China; Youxin, Song, Institute of Space Medico, China; Zhiheng, Liu, Institute of Space Medico, China; Space Medicine and Medical Engineering, Vol. 8, No. 4; Dec. 1995, pp. 253-256; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Six kinds of microorganisms were carried in the Space Microbial Cultivator onboard a recoverable satellite for 15 days from July 3, 1994. They were exposed to an environment of microgravity and high dosage radiation. The results showed all strains were alive after the flight; lots of variation of Tobramycin-producing strains occurred; 15 percent of Trp and Ade deficiency strains lost their Trp deficiency feature; activity enzyme produced by *Bacillus megaterium* was 11.6% higher than before; SOD content in monoploid yeast was higher after flight but it has no change in biploid yeast.

Author

*Microorganisms; Spaceborne Experiments; Cultivation; Gravitational Effects*

**19960020563**; 96N24112 Institute of Space Medico, Beijing, China

**Effects of simulated weightlessness and radiation on immune function and beta-endorphin production in pituitary in rats**

Tao, Wang, Institute of Space Medico, China; Guanghua, Yang, Institute of Space Medico, China; Xiulan, Wen, Institute of Space Medico, China; Space Medicine and Medical Engineering, Vol. 8, No. 4; Dec. 1995, pp. 257-261; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Effect of the short-term simulated weightlessness (SWL), radiation and SWL plus radiation on the immune function in rats was studied and the mechanisms were investigated. The result showed that: (1) after 3 d of SWL, no change was found in T lymphocyte proliferation, activity of IL-2 and IL-1. After 7 d of SWL, T lymphocyte proliferation decreased significantly, the activity of IL-2 and IL-1 tended to decrease. (2) after 3 d of 2 Gy Co-60 whole body irradiation, decrease

of T lymphocyte proliferation and activity of IL - 2 was observed, but activity of IL - 1 increased significantly. After 7 d irradiation, these parameters tended to increase, but still less than these in normal group, the activity of IL-1 was increased, but still higher than these in normal group. (3) after 3 d of SWL plus radiation, decrease of T lymphocyte proliferation and activity of IL-2 was observed; after 7 d, the change of activity of IL-2 was similar to that after 3 d and activity of IL-1 tended to increase. (4) after 3 d stimulation of three factors, production of beta-endorphin (beta-EP) in pituitary tended to decrease (especially after irradiation), after 7 d, the production of beta-EP decreased significantly. The change of immune function showed the similar trend with the change of production of beta - EP. These results demonstrated that the decrease of immune function observed in this study might be related to the decrease of production of beta-EP.

Author

*Weightlessness Simulation; Pituitary Hormones; Radiation Effects; Gravitational Effects; Immune Systems; Physiological Effects*

**19960020564**; 96N24113 Institute of Space Medico, Beijing, China

**Effects of simulated weightlessness on hemopoiesis and morphology of red blood cell in rabbits**

Jianhe, Chen, Institute of Space Medico, China; Xianyun, Shen, Institute of Space Medico, China; Jingrui, Meng, Institute of Space Medico, China; Qiulu, Xiang, Institute of Space Medico, China; Shuling, Qi, Institute of Space Medico, China; Jinhua, Liu, Institute of Space Medico, China; Space Medicine and Medical Engineering; Dec. 1995, pp. 280-282; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Effects of simulated weightlessness (SWL) Head-down-tilt on red blood cell morphology and bone marrow function in rabbits were observed. After SWL, increased number of abnormal red blood cells, more concentrated hematopoietic cells, change of hematopoietic microenvironment, more nuclear pores in reticulocytes, expanded endoplasmic reticulum in reticulocytes, emerging of juvenile red blood cells into bone marrow blood sinus and megakaryocyte, and bubbles in endothelial cells were observed. The results show that SWL has certain effects on the morphology and function of red blood cell and bone marrow.

Author

*Weightlessness Simulation; Gravitational Effects; Cytology; Blood Cells; Hematopoietic System; Bone Marrow*

**19960020565**; 96N24114 Institute of Space Medico, Beijing, China

**Possibility of application of capillary pumped loop in manned space cabins thermal environment control**

Jing, Liu, Institute of Space Medico, China; Xuexue, Zhang,

Institute of Space Medico, China; Zepei, Ren, Institute of Space Medico, China; Space Medicine and Medical Engineering; Dec. 1995, pp. 284-289; In Chinese; Also announced as 1996039533; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Energy consumed by currently existing thermal control system in manned space cabin is great and a lot of complex heat exchangers are needed. A new heat transmission system, the capillary pumped loop, has recently been developed. Its working principles, heat transfer performance and temperature regulation, are discussed. The possibilities and meanings of application of this non-dynamic temperature regulation system based on CPL theory to the thermal control inside a manned space cabin, as well as its difficulties and solutions that existed were also discussed.

Author

*Spacecraft Environments; Thermal Environments; Environmental Control; Heat Exchangers; Heat Transfer; Temperature Control*

**19960020566**; 96N24115 Institute of Space Medico, Beijing, China

**Possibility of Application of the Principles of Differentiation and Treatment of Common Syndromes of the Traditional Chinese Medicine in Manned Spaceflight**

Jinhe, Wei, Editor, Institute of Space Medico, China; Tiande, Yang, Editor, Institute of Space Medico, China; Jianfeng, Fan, Editor, Institute of Space Medico, China; Duansheng, Huang, Editor, Institute of Space Medico, China; Zheng, Xu, Editor, Institute of Space Medico, China; Yincheng, Lu, Editor, Institute of Space Medico, China; Xueqi, Yang, Editor, Institute of Space Medico, China; Zhijun, Xiao, Editor, Institute of Space Medico, China; Yong, Liu, Editor, Institute of Space Medico, China; Space Medicine and Medical Engineering; Dec. 1995, pp. 290; In English; Also announced as 1996039533; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

For the purpose of enhancing the application of the traditional Chinese medicine in the area of spaceflight, the physiological effects of spaceflight environment (including microgravity, radiation, isolated narrow- small space, change of biological rhythm) on the human body were discussed and reviewed. Changes in the beginning period of spaceflight are considered as excess syndrome, and its differentiation of syndromes are chaotic meridian Qi and blood, abnormal ascend and descend of the visceral Qi and blood. The principles of its treatment are to ascend the Lucid Yang, to keep the Turbid-Yin downwards, and to promote flow of Qi and blood circulation. Changes in the middle and later stage are considered as deficiency syndrome complicated with excess, and its differentiation is deficiency of the liver-Yin and the kidney-Yin, complicated with stagnation of Qi and blood stasis. The principles of its treatment are to nourish the kidney-Yin and

the liver-Yin, to invigorate the spleen, replenish Qi and to activate blood circulation.

Author

*Aerospace Medicine; Signs And Symptoms; Physiological Effects; Gravitational Effects; Microgravity; Manned Space Flight*

**19960020717**; 96N24240 Puerto Rico Univ., Chemical Engineering Dept., Mayaguez, Puerto Rico

**On-line removal of volatile fatty acids from CELSS anaerobic bioreactor via nanofiltration**

Colon, Guillermo, Puerto Rico Univ., Puerto Rico; The 1995 Research Reports: NASA/ASEE Summer Faculty Fellowship Programs; Nov. 1995, pp. 87-120; In English; Also announced as 1996007740; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The CELSS (controlled ecological life support system) resource recovery system, which is a waste processing system, uses aerobic and anaerobic bioreactors to recover plants nutrients and secondary foods from the inedible biomass. The anaerobic degradation of the inedible biomass by means of culture of rumen bacteria, generates organic compounds such as volatile fatty acids (acetic, propionic, butyric, VFA) and ammonia. The presence of VFA in the bioreactor medium at fairly low concentrations decreases the microbial population's metabolic reactions due to end-product inhibition. Technologies to remove VFA continuously from the bioreactor are of high interest. Several candidate technologies were analyzed, such as organic solvent liquid-liquid extraction, adsorption and/or ion exchange, dialysis, electro dialysis, and pressure driven membrane separation processes. The proposed technique for the on-line removal of VFA from the anaerobic bioreactor was a nanofiltration membrane recycle bioreactor. In order to establish the nanofiltration process performance variables before coupling it to the bioreactor, a series of experiments were carried out using a 10,000 MWCO tubular ceramic membrane module. The variables studied were the bioreactor slurry permeation characteristics, such as, the permeate flux, VFA and the nutrient removal rates as a function of applied transmembrane pressure, fluid recirculation velocity, suspended matter concentration, and process operating time. Results indicate that the permeate flux, VFA and nutrients removal rates are directly proportional to the fluid recirculation velocity in the range between 0.6 to 1.0 m/s, applied pressure when these are low than 1.5 bar, and inversely proportional to the total suspended solids concentration in the range between 23,466 to 34,880. At applied pressure higher than 1.5 bar the flux is not more linearly dependent due to concentration polarization and fouling effects over the membrane surface. It was also found that the permeate flux declines rapidly during the first 5 to 8 hours, and then levels off with a diminishing rate of flux decay.

Author

*Adsorption; Ammonia; Bacteria; Biomass; Bioreactors;*

*Closed Ecological Systems; Fatty Acids; On-Line Systems; Organic Compounds; Biodegradation*

**19960020729**; 96N24252 Colorado State Univ., Dept. of Chemical and Bioresource Engineering., Fort Collins, CO USA

**An analysis of alternative technologies for the removal of ethylene from the CELSS biomass production chamber**

Rakow, Allen L., Colorado State Univ., USA; The 1995 Research Reports: NASA/ASEE Summer Faculty Fellowship Programs; Nov. 1995, pp. 453-472; In English; Also announced as 1996007740; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A variety of technologies were analyzed for their potential to remove ethylene from the CELSS Biomass Production Chamber (BPC). During crop production (e.g., lettuce, wheat, soybean, potato) in the BPC ethylene can accumulate in the airspace and subsequently affect plant viability. The chief source of ethylene is the plants themselves which reside in plastic trays containing nutrient solution. The main sink for ethylene is chamber leakage. The removal technology can be employed when deleterious levels (e.g., 50 ppb for potato) of ethylene are exceeded in the BPC and perhaps to optimize the plant growth process once a better understanding is developed of the relationship between exogenous ethylene concentration and plant growth. The technologies examined were catalytic oxidation, molecular sieve, cryotrapping, permanganate absorption, and UV degradation. Upon analysis, permanganate was chosen as the most suitable method. Experimental data for ethylene removal by permanganate during potato production was analyzed in order to design a system for installation in the BPC air duct. In addition, an analysis of the impact on ethylene concentration in the BPC of integrating the Breadboard Scale Aerobic Bioreactor (BSAB) with the BPC was performed. The result indicates that this unit has no significant effect on the ethylene material balance as a source or sink.

Author

*Biomass; Bioreactors; Ethylene; Permanganates; Removal; Vegetation Growth*

**19960020837**; 96N24360 Japanese Air Self-Defense Force, Aeromedical Lab., Tokyo, Japan

**The Effects of a Hypobaric Hypoxic Environment on the Blood Coagulation System in Rats**

Tajima, Fumiko, Japanese Air Self-Defense Force, Japan; Nakata, Yasuko, Japanese Air Self-Defense Force, Japan; Nakanishi, Kuniaki, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory; Sep. 1994, pp. 37-43; In Japanese; Also announced as 1996037768; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High altitude hypoxia is known to cause polycythemia and a state of hypercoagulability in man and animals. The present study investigates the effects of a hypobaric hypoxic

environment (HHE) on the blood coagulation system in rats. Ninety six male Wistar rats were housed for 1 to 12 weeks in a chamber that simulated an altitude of 18,000ft. After 2 weeks of the HHE, the platelet counts decreased significantly and prothrombin time and activated partial thromboplastin time prolonged significantly after 4 weeks, compared with controls. In addition, individual coagulation factors such as II, VII, VIII, IX, X, XI, and XII were significantly decreased at 8 weeks. Levels of anti thrombin III and alpha(sub 2) -plasmin inhibitor also decreased between 4 and 8 weeks. Thirty of 56 rats (54%) had thrombus of the heart and / or kidney. The incidence of thrombus increased from 33 % ( 5/15 rats ) at 4 weeks to 100 % (7/7 rats) at 12 weeks. These results suggest that HHE induces a state of hypercoagulability and causes thrombus formation in rats, which may lead to consumption coagulopathy.

Author

*Blood Coagulation; High Altitude; Hypoxia; Thrombin*

## 52

### AEROSPACE MEDICINE

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

**19960016648;** 96N22273 NASA Ames Research Center, Moffett Field, CA USA

#### **Crew Factors in Flight Operations 6: Psychophysiological Responses to Overnight Cargo Operations**

Gander, Philippa H., San Jose State Univ., USA; Gregory, Kevin B., Sterling Software, Inc., USA; Connell, Linda J., NASA Ames Research Center, USA; Miller, Donna L., Sterling Software, Inc., USA; Graeber, R. Curtis, NASA Ames Research Center, USA; Rosekind, Mark R., NASA Ames Research Center, USA; Feb. 1996, pp. 62; In English

Contract(s)/Grant(s): RTOP 505-64-53

Report No.(s): NASA-TM-110380; A-961057; NAS 1.15:110380; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To document the psychophysiological effects of flying overnight cargo operations, 41 B-727 crew members (average age 38 yr) were monitored before, during, and after one of two typical 8-day trip patterns. During daytime layovers, the average sleep episode was 3 hr (41%) shorter than nighttime sleeps and was rated as lighter, less restorative, and poorer overall. Sleep was frequently split into several episodes and totaled 1.2 hr less per 24 hr than on pretrip days. Each trip pattern included a night off, which was an effective countermeasure against the accumulating sleep debt. The organization of sleep during daytime layovers reflected the interaction of duty timing with circadian physiology. The circadian temperature rhythm did not adapt completely to the inverted wake-rest schedule on duty days, being delayed by about 3 hr. Highest subjective fatigue and lowest activation occurred around the

time of the temperature minimum. On duty days, reports of headaches increased by 400%, of congested nose by 200%, and of burning eyes by 900%. Crew members also reported eating more snacks. Compared with daytime short-haul air-transport operations, the overnight cargo trips included fewer duty and flight hours, and had longer layovers. Overnight cargo crews also averaged 5.4 yr younger than their daytime short-haul counterparts. On trips, both groups lost a comparable amount of sleep per 24 hr, but the overnight cargo crews had shorter individual sleep episodes and more broken sleep. These data clearly demonstrate that overnight cargo operations, like other night work, involve physiological disruption not found in comparable daytime operations.

Author

*Physiological Responses; Evoked Response (Psychophysiology); Workloads (Psychophysiology); Circadian Rhythms; Schedules; Sleep; Flight Crews*

**19960016660;** 96N22278 NASA Langley Research Center, Hampton, VA USA

#### **Variations in astronaut radiation exposure due to anisotropic shield distribution**

Wilson, John W., NASA Langley Research Center, USA; Nealy, John E., NASA Langley Research Center, USA; Wood, James S., Flight Mechanics and Control, Inc., USA; Qualls, Garry D., Flight Mechanics and Control, Inc., USA; Qualls, Garry D., Flight Mechanics and Control, Inc., USA; Atwell, William, Rockwell International Corp., USA; Shinn, Judy L., NASA Langley Research Center, USA; Simonsen, Lisa C., NASA Langley Research Center, USA; ISSN 0017-9078, pp. 12; In English

Report No.(s): NASA-TM-111337; NAS 1.15:111337; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dose incurred in an environment generated by extra-terrestrial space radiations within an anisotropic shield distribution depends on the orientation of the astronaut's body relative to the shield geometry. The fluctuations in exposure of specific organ sites due to astronaut re-orientation are found to be a factor of 2 or more in a typical space habitation module and typical space radiations. An approximation function is found that overestimates astronaut exposure in most cases studied and is recommended as a shield design guide for future deep space missions.

Author

*Extraterrestrial Radiation; Astronauts; Radiation Dosage; Radiation Shielding; Risk; Aerospace Medicine; Variations; Anisotropy; Spatial Distribution*

**19960016932;** 96N22539 Norwegian Defence Research Establishment, Forsvarets Forskningsinstitut., Kjeller, Norway

#### **The cerebral metabolism of amino acids and related metabolites as studied by C-13 and C-14 labelling**

Hassel, Bjornar, Norwegian Defence Research Establishment, Norway; Nov. 1995, pp. 118; In English Report No.(s): NDRE-Publ-95/05140; ISBN 82-464-0032-0; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The present investigations show the feasibility of analyzing the cerebral metabolism of amino acids and related metabolites by C-13 and C-14 labelling using labelled acetate and glucose as markers for glial and neuronal metabolism, respectively. Using (C-13) acetate, it was shown that glial cells export approximately 60% of their TCA cycle intermediates, mostly as glutamine, and that this glutamine is used by neurons partly as an energy reserve, partly it is converted directly to glutamate and GABA. Using (C-13) glucose, the glial process of pyruvate carboxylation was shown to compensate fully for the loss of glutamine. The mechanism of action of two neurotoxins, fluorocitrate and 3-nitropropionate, was elucidated. The latter toxin was shown to inhibit the TCA cycle of GABAergic neurons selectively. Formation of pyruvate and lactate from glial TCA cycle intermediates was demonstrated in vivo. This pathway may be important for the glial inactivation of transmitter glutamate and GABA. The results illustrate glianeuronal interactions, and they suggest the applicability of C-13 NMR spectroscopy to the detailed study of the cerebral metabolism of amino acids in the intact, unanesthetized human brain.

Author

*Amino Acids; Carbon 13; Carbon 14; Metabolites; Cerebrum; Metabolism; Neurons; Isotopic Labeling; Brain*

**19960017277**; 96N22868 Texas A&M Univ., Dept. of Nuclear Engineering., College Station, TX USA

**Investigation of Natural and Man-Made Radiation Effects on Crews on Long Duration Space Missions *Final Report***

Bolch, Wesley E., Texas A&M Univ., USA; Parlos, Alexander, Texas A&M Univ., USA; Feb. 1996, pp. 144; In English Contract(s)/Grant(s): NAG3-1326; RTOP 506-31-3M

Report No.(s): NASA-CR-195424; E-9371; NAS 1.26:195424; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Over the past several years, NASA has studied a variety of mission scenarios designed to establish a permanent human presence on the surface of Mars. Nuclear electric propulsion (NEP) is one of the possible elements in this program. During the initial stages of vehicle design work, careful consideration must be given to not only the shielding requirements of natural space radiation, but to the shielding and configuration requirements of the on-board reactors. In this work, the radiation transport code MCNP has been used to make initial estimates of crew exposures to reactor radiation fields for a specific manned NEP vehicle design. In this design, three 25 MW(sub th), scaled SP-100-class reactors are shielded by three identical shields. Each shield has layers of beryllium,

tungsten, and lithium hydride between the reactor and the crew compartment. Separate calculations are made of both the exiting neutron and gamma fluxes from the reactors during beginning-of-life, full-power operation. This data is then used as the source terms for particle transport in MCNP. The total gamma and neutron fluxes exiting the reactor shields are recorded and separate transport calculations are then performed for a 10 g/sq cm crew compartment aluminum thickness. Estimates of crew exposures have been assessed for various thicknesses of the shield tungsten and lithium hydride layers. A minimal tungsten thickness of 20 cm is required to shield the reactor photons below the 0.05 Sv/y man-made radiation limit. In addition to a 20-cm thick tungsten layer, a 40-cm thick lithium hydride layer is required to shield the reactor neutrons below the annual limit. If the tungsten layer is 30-cm thick, the lithium hydride layer should be at least 30-cm thick. These estimates do not take into account the photons generated by neutron interactions inside the shield because the MCNP neutron cross sections did not allow reliable estimates of photon production in these materials. These results, along with natural space radiation shielding estimates calculated by NASA Langley Research Center, have been used to provide preliminary input data into a new Macintosh-based software tool. A skeletal version of this tool being developed will allow rapid radiation exposure and risk analyses to be performed on a variety of Lunar and Mars missions utilizing nuclear-powered vehicles.

Author

*Nuclear Electric Propulsion; Radiation Dosage; Radiation Shielding; Long Duration Space Flight; Manned Mars Missions; Manned Space Flight; Spacecraft Shielding; Neutrons; Gamma Rays*

**19960017310**; 96N22901 North Dakota State Univ., Dept. of Electrical Engineering., Fargo, ND USA

**The Ventriculo-Arterial Coupling Ratio During Transient Gz Events**

Offerdahl, C. D., North Dakota State Univ., USA; Ewert, D. L., North Dakota State Univ., USA; Crisman, R. P., Armstrong Lab., USA; Convertino, V. A., Armstrong Lab., USA, pp. 8

Report No.(s): AD-A300586; AL/AO-JA-1995-0108; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It has been shown by Westerhof et al. that the ratio  $\tau/T$  (where  $\tau = R_p \times SAC$  and  $R_p$  is total peripheral resistance, SAC is systemic arterial compliance, and T is heart period) is approximately a constant in all mammals under resting conditions such that diastolic pressure is sufficiently high to assure adequate coronary perfusion. The aim of this study is to determine if the ratio  $\tau/T$  is constant under the transient condition of a rapid onset rate +Gz acceleration. We hypothesize that the ratio is held constant by the cardiovascular control system. Four male baboons were subjected to 10 second rapid onset +Gz profiles and aortic pressure and flow were recorded.  $R_p$

and C were calculated using a 2-element windkessel model T was determined by the inverse of heart rate. All parameters were calculated on a beat-to-beat basis. It was found that the ratio increased very little at +2 Gz and increased dramatically at +3 and +5 Gz, disproving our hypothesis. This increase was due to large increases in peripheral resistance and changes in heart rate over the course of a Gz run. The increases are presumed to represent baroreceptor reflex response to the drop in aortic pressure experienced during +Gz stress. The ratio tau/T returned to its initial resting value shortly after the +Gz stressor was removed.

DTIC

*Arteries; Cardiovascular System; Diastolic Pressure; Heart; Baboons; Heart Rate*

**19960017335**; 96N22926 Pittsburgh Univ., Dept. of Psychiatry., Pittsburgh, PA USA

**Society for Research on Biological Rhythms Symposium Final Report, 15 Apr. 1994 - 15 Apr. 1995**

Moore, Robert, Pittsburgh Univ., USA, pp. 30; Society for Research on Biological Rhythms Symposium, 4-8 May, 1994, Jacksonville, FL, USA

Contract(s)/Grant(s): F49620-94-1-0250

Report No.(s): AD-A300300; AFOSR-TR-95-0692; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Funds were provided to support the meeting of the Society for Research on Biological Rhythms held from 4-8 May 1994 at Amelia Island, Florida. The meeting was attended by approximately 400 scientists from biological rhythm centers throughout the USA and Canada and from 10 countries abroad. The objectives of the meeting was to promote biological rhythm research through interchange of information in formal settings and informal interaction. An important aspect of the interactions is to promote research directly related to the interests of the Air Force in ameliorating the effects of jet lag and sleep deprivation on performance.

DTIC

*Conferences; Jet Lag; Rhythm (Biology); Sleep Deprivation; Regulatory Mechanisms (Biology); Photosensitivity*

**19960017626**; 96N23182 Pennsylvania Univ. Medical Center, Inst. for Environmental Medicine., Philadelphia, PA USA

**CO<sub>2</sub>-O<sub>2</sub> Interactions in Extension of Tolerance to Acute Hypoxia Annual Report No. 1, 1 Apr. 1995 - 31 Mar. 1996**

Lambertsen, C. J., Pennsylvania Univ. Medical Center, USA; Gelfand, R., Pennsylvania Univ. Medical Center, USA, pp. 14; In English

Contract(s)/Grant(s): NAGw-4359

Report No.(s): NASA-CR-200291; NAS 1.26:200291; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advantageous and/or detrimental influences associated with purposeful deviations from atmospheric levels of O<sub>2</sub> and CO<sub>2</sub> are studied. Specific goals have been directed to simulat-

ing situations of emergency or accidental exposure to hypoxic (10% O<sub>2</sub>) environments. They included establishing dynamic effects of hypoxia with and without CO<sub>2</sub> (rate of acute adaptation), and stable-state (equilibrium) effects on blood and brain oxygenation. They also included effects on the physiological parameters of respiration and blood gas composition which underlie brain oxygenation. For 10% O<sub>2</sub>, a complete experiment consisted of three identical rest-exercise phases of 32 minutes duration. Following a five minute air control period, each inspired gas was administered over the next 27 minutes. The test gases were room air control, 10% +/- 0.1% O<sub>2</sub> with 4% +/- 0.1% CO<sub>2</sub>, and 10% +/- 0.1% O<sub>2</sub>. A minimum of 45 minutes separated each phase. Relative to inspiration of 10% O<sub>2</sub>, brain oxygenation is enhanced by addition of 4% CO<sub>2</sub>. This is accomplished by increasing the rate at which O<sub>2</sub> in arterial blood is supplied to the brain circulation (well above even the normoxic level), and on relative improvement in the arterial pressure of O<sub>2</sub>.

Derived from text

*Brain Circulation; Carbon Dioxide Concentration; Hypoxia; Oxygenation; Human Tolerances; Physical Exercise*

**19960017686**; 96N23218 Wichita State Univ., Wichita, KS USA

**A Multibody/Finite Element Analysis Approach for Modeling of Crash Dynamic Responses**

Ma, Deren, Wichita State Univ., USA; 1994, pp. 208; In English; No Copyright; Avail: Univ. Microfilms Order No. DA9505091, Hardcopy, Microfiche

Occupant models are robust tools for gaining insight into the gross motion of ground vehicle or aircraft occupants and evaluating loads and deformations of their critical parts in the studies of crashworthiness. One of the most important issues in occupant modeling is how the large motion of rigid segments of occupants such as the limbs and the small deformations of flexible bodies such as the spine column are handled. In this dissertation, mathematical models of the occupants with a finite element model of the spine are developed based on the principles of the rigid/flexible multibody dynamics and finite element methods along with numerical techniques. An exhaustive study of the occupant modeling and post-crash dynamic behavior of the vehicle occupants under various crash environments is performed by both experimental and analytical means. A methodology for the quasi-static analysis of multibody systems with flexible structures undergoing large motion and complicated structural deformations is first developed. Rigid multibody dynamics is used to predict gross motions and displacements at the boundaries at each time step. Finite element analysis is then performed to determine the corresponding loads and deformations on the entire structure. This methodology produces highly efficient numerical solutions for systems containing both rigid and flexible bodies. A general-purpose nonlinear finite element computer program was developed for the quasi-static analysis which would

address plane-frame problems with large displacements and mixed force and displacement boundary conditions. Based on the developed method, two finite element models of the lumbar spine are created: one for a Hybrid 11 (Part 572) anthropomorphic test dummy and one for a 50th percentile male human. Detailed information of kinematic, geometric, inertial and material properties of the lumbar spine are used for both models. These models are then incorporated into code SOM-LA/TA (Seat Occupant Model-Light Aircraft/Transport Aircraft). The analytical results obtained from the modified code are correlated to the experimental results from the impact sled tests. Comparison of the results showed much closer match of the analyses to the experiments than it has been predicted by the original SOM-LA/TA code. With the validated occupant model containing the lumbar spine, the gross motion of occupant segments, including displacements, velocities and accelerations are evaluated. The spinal axial loads, bending moments, shear forces, internal forces, nodal forces, and deformation time histories are also determined. In addition, variables such as Head Injury Criteria (HIC), Severity Index (SI) and Dynamic Response Index (SI) are evaluated to determine possibilities of the injuries in particular crash scenario. This detailed information helps assess the level of spinal injury, determine mechanisms of spinal injury, and design and develop better occupant safety devices.

Dissert. Abstr.

*Back Injuries; Crashworthiness; Flexible Bodies; Human Body; Impact Tests; Transport Aircraft; Safety Devices; Spine*

**19960020463**; 96N24035 San Jose State Univ., Dept. of Psychology., CA USA

**Self Motion Perception and Motion Sickness Final Report, 1982 - 1991**

Fox, Robert A., Principal Investigator, San Jose State Univ., USA; 1991, pp. 20; In English

Contract(s)/Grant(s): NCC2-167

Report No.(s): NASA-CR-200819; NAS 1.26:200819; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The studies conducted in this research project examined several aspects of motion sickness in animal models. A principle objective of these studies was to investigate the neuroanatomy that is important in motion sickness with the objectives of examining both the utility of putative models and defining neural mechanisms that are important in motion sickness.

Derived from text

*Motion Sickness; Motion Perception; Behavior; Physiological Responses; Stimuli*

**19960020623**; 96N24160 NASA Johnson Space Center, Houston, TX USA

**Estimate of Space Radiation-Induced Cancer Risks for International Space Station Orbits**

Wu, Honglu, Krug International, USA; Atwell, William, Rockwell Space Operations Co., USA; Cucinotta, Francis A.,

NASA Langley Research Center, USA; Yang, Chui-hsu, NASA Johnson Space Center, USA; Mar. 1996, pp. 72; In English

Report No.(s): NASA-TM-104818; NAS 1.15:104818; S-806; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Excess cancer risks from exposures to space radiation are estimated for various orbits of the International Space Station (ISS). Organ exposures are computed with the transport codes, BRYNTRN and HZETRN, and the computerized anatomical male and computerized anatomical female models. Cancer risk coefficients in the National Council on Radiation Protection and Measurements report No. 98 are used to generate lifetime excess cancer incidence and cancer mortality after a one-month mission to ISS. The generated data are tabulated to serve as a quick reference for assessment of radiation risk to astronauts on ISS missions.

Author

*Cancer; Radiation Protection; Risk; Computerized Simulation; International Space Station; Extraterrestrial Radiation*

**19960020810**; 96N24333 Building Research Establishment, Fire Research Station., Watford, UK

**Smoke toxicity**

Purser, David, Building Research Establishment, UK; Improved Fire- and Smoke-Resistant Materials for Commercial Aircraft Interiors: A proceedings; 1995, pp. 175-196; In English; Also announced as 1996008530; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

When aircraft cabin occupants are exposed to fire effluent the first hazard encountered is usually smoke, containing particulates and toxic gases that cause immediate visual obscuration and painful irritation of the eyes and respiratory tract. This may be followed by incapacitation due to pain or asphyxia if exposure continues. In smouldering or small, confined, in-flight fires where the yields of organic irritants and acid gases are likely to be high and exposure times long, the distressing effects of irritants, lung inflammation, and asphyxia induced by carbon monoxide (CO) are likely to be the main hazards. For post-crash fires, which tend to develop rapidly to flashover, the time available for escape is often limited to a few minutes before conditions become lethal due to the effects of toxic smoke and heat, so that survival depends upon a rapid egress. Visual obscuration and smoke irritancy are important during the early stages in that they may reduce the speed and efficiency of escape. People have been shown to be reluctant to enter smoke-logged areas as these are between them and an exit, and movement speeds are greatly reduced at optical densities above 0.5, OD/m and even more when the smoke is irritant. Once cabin lining and seating materials become heavily involved in the area opposite a cabin breach, then the concentrations of toxic gases, especially CO and hydrogen cyanide (HCN), can increase rapidly further down the cabin, causing rapid incapacitation of any

remaining cabin occupants. This is followed or accompanied by extreme heat, so that deaths result from asphyxia and/or heat shock. For in-flight fires, it is recommended that consideration should be given to reducing the hazard from irritants. For post-crash fires, measures aimed at delaying the involvement of cabin contents (such as spray mist systems) should be considered.

Derived from text

*Fires; Smoke; Combustion Products; Gas Composition; Toxic Hazards; Flight Hazards; Crash Landing; Aircraft Hazards; Physiological Effects; Assessments; Toxicity*

**19960020836**; 96N24359 Japanese Air Self-Defense Force, Aeromedical Lab., Tokyo, Japan

**The Reports of Aeromedical Laboratory, Volume 35**

Sep. 1994; ISSN 0023-2858, pp. 44; In Japanese; In English; Also announced as 1996037768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current issue of The Reports of Aeromedical Laboratory discusses the following topics: (1) The effects of a hypobaric hypoxic environment on the blood coagulation system in rats; (2) A study on evaluation of flight aptitude by simulator; (3) Spontaneous pneumothorax in Japan air self defense force aviators, a retrospective study; and (4) Reading times of EFIS (Electrical Flight Instrument System) by using eye mark recorder.

CASI

*Aerospace Medicine; Blood Coagulation; Flight Instruments; Flight Simulators*

**19960020839**; 96N24362 Japanese Air Self-Defense Force, Aeromedical Lab., Tokyo, Japan

**Spontaneous Pneumothorax in Japan Air Self Defense Force Aviators: A Retrospective Study**

Kikukawa, Azusa, Japanese Air Self-Defense Force, Japan; Sugiyama, Keisaku, Japanese Air Self-Defense Force, Japan; Takagi, Keigo, National Defense Medical Coll., Japan; The Reports of Aeromedical Laboratory; Sep. 1994, pp. 57-62; In Japanese; Also announced as 1996037768; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Spontaneous pneumothorax(SP)is potentially hazardous to aviators, because it might cause inflight incapacitation. A retrospective study was carried out by reviewing the cases of 17 pilots with a history of SP found in the Japan Air Self Defense Force (JASDF) Waiver File at the JASDF Aeromedical Lab. The SP cases were treated by bullectomy based on thoracotomy. Sixteen aviators reobtained their aeromedical qualification after six months of grounded time and high altitude chamber training. One pilot failed due to another physical problem. Three SP cases (No.15 to approximately No.17) applied thoracoscopic bullectomy showed minimum postoperative morbidity, and shortened grounded time. None of the

SP cases experienced recurrence after these surgical or endoscopic manipulation.

Author

*Aircraft Pilots; Physiological Effects; Pneumothorax; Aerospace Medicine*

**19960020841**; 96N24364 Norwegian Defence Research Establishment, Kjeller, Norway

**Medical Consequences in Young Men of Prolonged Physical Stress with Sleep and Energy Deficiency**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway, pp. 160; In English; Also announced as 1996038023

Report No.(s): NDRE/Publication-95/05586; ISBN-82-464-0043-6; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

The medical consequences of sustained military operations have been studied in cadets from the Norwegian Military Academy during military training courses with physical activities day and night combined with lack of sleep and food. The increased catecholamine responses to a standardized exercise, downregulation of Beta-receptors and decreased cAMP responses to adrenaline stimulation indicate an adrenergic desensitization. Conjugated catecholamines increased during prolonged exercise but marginally during short term exercise. The increased catecholamine levels during the course were mainly due to physical exercise, whereas alterations in cortisol and growth hormone were partly reversed by extra food, whereas extra sleep did not have any major influence. Both testicular and adrenal androgens decreased during the course. The decreased levels of gonadotropins and their increased responses to hypothalamic releasing hormone indicate that the decreased secretion of testicular androgens is due to decreased hypothalamic secretion of releasing hormone. The circadian rhythm of all steroid hormones was extinguished during the course in contrast to the increased amplitude of the circadian rhythm of mental performance. In conclusion, these alterations may affect functions which are the basis for the subjects' mental and physical performance. Some of these alterations are necessary adaptations in order to maintain mental and physical performance capacity, whereas other alterations may impair performance, be harmful and produce diseases which should be avoided or treated.

Author

*Physical Exercise; Sleep Deprivation; Fasting; Circadian Rhythms; Hormones; Physiological Responses; Exercise Physiology; Long Term Effects*

**19960020842**; 96N24365 Norwegian Defence Research Establishment, Kjeller, Norway

**Alterations in the Morning Plasma Levels of Hormones and the Endocrine Responses to Bicycle Exercise During**

### **Prolonged Strain. The Significance of Energy and Sleep Deprivation**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway; Medical Consequences in Young Men of Prolonged Physical Stress with Sleep and Energy Deficiency, pp. 9; Repr. from *Acta Endocrinologica* (Copenhagen, Denmark), 1991, v. 125 p 14-22; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

The relative significance of physical exercise, energy and sleep deprivation for the morning levels of hormones and the endocrine response to short-term bicycle exercise were investigated in 24 male cadets during a 5-day military training course. Significant increases in the morning levels of noradrenaline, adrenaline, and dopamine, and a decrease in PRL were ascribed mainly to physical strain. Cortisol and hGH increased, whereas insulin and glucose decreased mainly due to energy deficiency. Pulse rate after the bicycle test was unchanged and similar in all groups in spite of increased catecholamine responses. The increased catecholamine response was mainly due to physical strain. The cortisol response to the bicycle test was increased in all groups, and energy deficiency caused slower postexercise recovery. The incremental hGH response to the exercise test was unchanged in the energy-deficient subjects but abolished in the well-fed subjects. The results suggest that the endocrine responses during long-lasting exhausting strain were mainly due to physical exertion and energy deficiency, whereas sleep deprivation did not play any major role.

Author

*Hormones; Physical Exercise; Sleep Deprivation; Physiological Responses; Endocrinology; Exercise Physiology; Blood Plasma*

**19960020843**; 96N24366 Norwegian Defence Research Establishment, Kjeller, Norway

### **Adrenergic Desensitization and Alterations in Free and Conjugated Catecholamines During Prolonged Strain, Sleep and Energy Deficiency**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway; ISSN 0168-8561, pp. 15; Repr. from *Biogenic Amines* (England, Pergamon Press), v. 7, no. 6, 1990 p 625-639; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

The pulse rate, blood pressure, free and conjugated catecholamine response to a bicycle exercise test with a workload of about 60 percent of VO<sub>2</sub>(max) were investigated in a control experiment and after 4-5 days of continuous exercise combined with sleep and energy deficiency. In a separate group the effect of glucose infusion during the exercise test was investigated. The free catecholamine response during the

exercise test was increased during the course with only small variations in the pulse rate and blood pressure responses. Glucose infusion during the exercise test markedly reduced the noradrenaline response, while the pulse rate response was only slightly affected. Conjugated noradrenaline and adrenaline increased 2-3-fold during the course, whereas conjugated dopamine did not change. There were only small variations in the plasma levels of conjugated catecholamines during the 30-min bicycle exercise test. Great inter-individual variations in conjugated dopamine levels were found in the control experiment, performed after an overnight fast. These variations were reduced during the course, indicating that they could be caused by environmental factors such as nutrients.

Author

*Desensitizing; Catecholamine; Heart Rate; Blood Pressure; Physiological Responses; Physical Exercise; Exercise Physiology; Sleep Deprivation*

**19960020844**; 96N24367 Norwegian Defence Research Establishment, Kjeller, Norway

### **The Dynamic Response of the Beta2- and alpha2 Adrenoceptors in Human Blood Cells to Prolonged Exhausting Strain, Sleep and Energy Deficiency**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway; Bratveit, M., Norwegian Defence Research Establishment, Norway; Wiik, Pal, Norwegian Defence Research Establishment, Norway; Boyum, A., Norwegian Defence Research Establishment, Norway, pp. 16; Repr. from *Biogenic Amines* (England, Pergamon Press), v. 10, no. 4, 1994 p 329-344; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

Leucocyte Beta2-receptors and platelet alpha2-receptors were studied during a five days ranger training course with heavy physical activities day and night, energy deficiency and almost without sleep. The Beta2-adrenoceptors on granulocytes and mononuclear cells decreased to a minimum density and affinity after 2 and 4 days of activities, respectively. For the rest of the course the Beta2-receptors increased, however, without reaching control values at the end of the course. A significant decrease of about 15 percent was found on day 3 in both platelet alpha2-receptor density and affinity followed by an up-regulation to about 20 percent above control levels on day 5. A significant correlation ( $r = -0.6$  to  $-0.8$ ) between the Beta2-receptor density and affinity, and the plasma catecholamines was recorded during the first 2-3 days, indicating a homologous down-regulation. The regeneration of receptors in spite of high catecholamines reflects a predominance of heterologous up-regulation during the second half of the course. The results indicate that Beta-adrenergic receptor down-regulation contributes to attenuation of the adrenergic responsiveness during the first 2-3 days of exhausting physi-

cal activities, but is not sufficient to account for the desensitization seen after longer periods of stress.

Author

*Leukocytes; Platelets; Physical Exercise; Exercise Physiology; Physiological Responses; Blood Cells; Sleep Deprivation; Catecholamine; Adrenergics*

**19960020845**; 96N24368 Norwegian Defence Research Establishment, Div. for Environmental Toxicology., Kjeller, Norway

**Adrenaline Stimulated Cyclic Adenosine MonoPhosphate Response in Leucocytes is Reduced After Prolonged Physical Activity Combined With Sleep and Energy Deprivation**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway; Wiik, Pal, Norwegian Defence Research Establishment, Norway; Haugen, Ann-Helen, Norwegian Defence Research Establishment, Norway; Skrede, Knut Kristian, Norwegian Defence Research Establishment, Norway, pp. 5; Repr. from *European Journal of Applied Physiology and Occupational Physiology* (Springer-Verlag), v. 69, 1994 p 371-375; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

The mechanism for adrenergic desensitization during physical stress was studied by measuring I-125 - cyanopindolol (I-125 - CYP) binding sites and the adrenaline stimulated cyclic adenosine monophosphate (cAMP) responses in peripheral blood leucocytes from ten male cadets during a 5-day military training course. The cadets had physical activities around the clock corresponding to a daily energy consumption of about 40,000 kJ but with an intake of only 2,000 kJ, and only 1-3 h of sleep in the 5 days. During the course, the maximal cAMP response to adrenaline stimulation was reduced to about 45 percent in granulocytes and to 52 percent in mononuclear cells, and the half maximal response was obtained only at 5-10 times higher adrenaline concentrations than in the control experiment. The binding sites for I-125 - CYP in mononuclear cells increased during the course. However, I-125 - CYP measured not only surface receptors but also intracellular receptors and might even have represented other binding sites. In conclusion, this study showed that decreased cAMP response to adrenergic stimulation would seem to be one of the mechanisms behind adrenergic desensitization during stress.

Author

*Epinephrine; Leukocytes; Physical Exercise; Sleep Deprivation; Cyclic Amp; Physiological Responses; Fasting*

**19960020846**; 96N24369 Norwegian Defence Research Establishment, Div. for Environmental Toxicology., Kjeller, Norway

**Androgenic Hormones During Prolonged Physical Stress, Sleep, and Energy Deficiency**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway; ISSN 0021-972X, pp. 8; Repr. from *Journal of Clinical Endocrinology and Metabolism* (Endocrine Society), v. 74, no. 5, 1992 p 1176-1183; In English; Also announced as 1996038023; Copyright; Avail: Abstract Only (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

Androgenic hormones were investigated during two separate 5-day military endurance training courses, with physical activities around the clock corresponding to a daily energy consumption of about 40,000 kilojoules, but with an intake of only 2,000 kilojoules. Altogether, the cadets slept for 1-3 h in the 5 days. Eleven male cadets participated in course 1 and ten cadets in course 2. Plasma levels of testosterone, free testosterone, dehydroepiandrosterone, 17 alpha-hydroxyprogesterone, and androstenedione decreased by 60-80 percent during the course. In contrast, plasma cortisol, aldosterone, progesterone, and dehydroepiandrosterone sulfate increased. LH, FSH, and ACTH decreased to about 50-80 percent of pre-course levels. Weak correlations between plasma levels of hypophyseal and levels of adrenal and testicular hormones indicate a multi-factorial regulation. In conclusion, both adrenal and testicular androgens decrease during prolonged physical strain combined with energy and sleep deficiency.

Author

*Hormones; Physical Exercise; Fasting; Sleep Deprivation; Exercise Physiology; Physiological Responses*

**19960020847**; 96N24370 Norwegian Defence Research Establishment, Kjeller, Norway

**The Hypothalamo-Pituitary Regulation of Androgen Secretion in Young Men After Prolonged Physical Stress Combined with Energy and Sleep Deprivation**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway, pp. 6; Repr. from *Acta Endocrinologica* (Copenhagen, Denmark), v. 127, 1992 p 231-236; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

During a five days military training course for male cadets with hard physical activity day and night and almost no sleep or food, a decrease was found in LH, FSH, PRL and TSH. A decrease was also found in testosterone, dehydrotestosterone (DHT), androstenedione, dehydroepiandrosterone and 17 alpha-OH progesterone, whereas dehydroepiandrosterone sulfate increased twofold. The LH and FSH responses to GnRH intravenously were increased at the end of the course. This demonstrates enhanced pituitary reserves of gonadotropin, or, alternatively, increased sensitivity to GnRH

stimulation and may be due to decreased hypothalamic secretion of GnRH during the course. The decreased DHT and testosterone levels were almost normalized after HCG stimulation, indicating a gonadotropin regulated decrease in testosterone secretion during the course. In spite of fairly weak correlation between the alteration in gonadotropins and androgens it is concluded that there is a major regulation of testicular androgen secretion during prolonged stress by the hypothalamo-pituitary axis.

Author

*Physical Exercise; Sleep Deprivation; Pituitary Hormones; Hypothalamus; Long Term Effects; Exercise Physiology; Physiological Responses; Fasting*

**19960020848**; 96N24371 Norwegian Defence Research Establishment, Kjeller, Norway

**Circadian Rhythm of Hormones is Extinguished During Prolonged Physical Stress, Sleep and Energy Deficiency in Young Men**

Opstad, Per-Kristian, Norwegian Defence Research Establishment, Norway, pp. 11; Repr. from European Journal of Endocrinology, v. 131, 1994 p 56-66; In English; Also announced as 1996038023; Copyright; Avail: Issuing Activity (Norwegian Defence Research Establishment, Kjeller, Norway), Hardcopy, Microfiche

The circadian rhythm of hormones (N = 10) and mental performance (N = 18) was investigated in male cadets during a 5-day military training course with continuous heavy physical activities corresponding to 35 percent of the maximal oxygen uptake, with almost total lack of food and sleep. The 24-h means for androstenedione, dihydroepiandrosterone (DHEA), 17 alpha-hydroxyprogesterone, testosterone and thyroid-stimulating hormone decreased strongly during the course, and the circadian rhythm was extinguished below the minimum levels measured during the control experiment. The 24-h means for cortisol, dihydroepiandrosterone sulfate (DHEA-S) and progesterone increased during the course, and the circadian rhythm was abolished above the maximum levels of the control experiment. A gradual increase was found in thyroxine, free thyroxine and triiodothyronine during the first 12h of activities, followed by a constant decrease for the rest of the course. Mental performance decreased during the course and the amplitude of its circadian rhythm increased from +/- 10 percent to +/- 30 percent of the 24-h mean. The circadian rhythms investigated were almost normalized after 4-5 days of rest. However, the nocturnal rise for cortisol, androstenedione and DHEA appeared earlier, and the plasma levels of thyroid hormones, estradiol and DHEA-S were lower during the recovery experiment than in the control experiment. The responses to stress of the circadian rhythm for mental performance and steroid hormones during the course indicate a differential regulation.

Author

*Circadian Rhythms; Hormones; Physical Exercise; Sleep Deprivation; Mental Performance; Physiological Responses; Fasting; Exercise Physiology*

**19960020859**; 96N24382 Japanese Air Self-Defense Force, Tokyo, Japan

**The Reports of Aeromedical Laboratory, Volume 36**

Jun. 1995; ISSN 0023-2858, pp. 38; In Japanese; Also announced as 1996039350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

English abstracts are provided with the enclosed reports: comparison of physiological and psychological responses of experienced and unexperienced pilots to G-training; hormonal responses of students and instructor pilots during the initial phase of primary flight training course; and electrogastrographic response to motion sickness.

CASI

*Flight Training; Hormone Metabolisms; Physiological Responses; Acceleration Stresses (Physiology); Psychological Effects*

**19960020860**; 96N24383 Japanese Air Self-Defense Force, Tokyo, Japan

**Comparison of physiological and psychological responses of experienced and unexperienced pilots to G-training**

Onozawa, Akihiko, Japanese Air Self-Defense Force, Japan; Mizumoto, Chieko, Japanese Air Self-Defense Force, Japan; Okaue, Miyako, Japanese Air Self-Defense Force, Japan; Nakamura, Akio, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory, Vol. 36, No. 2; Jun. 1995, pp. 25-44; In Japanese; Also announced as 1996039350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to compare the physiological and psychological responses of experienced pilots and pilot candidates to G-training, heart rate and blood pressure changes of pilot candidates and experienced pilots were measured. Their psychological responses were also analyzed through the subjective assessment. The main results are as follows: (1) Both pilot candidates and experienced pilots showed significant increases of systolic blood pressure upon boarding the centrifuge gondola and just after the G-training. No significant difference was found between the two groups. (2) Diastolic blood pressure of pilot candidates elevated significantly during the centrifuge ride. Experienced pilots showed little change. (3) Heart rate increase of pilot candidates during G-training was greater than those observed in experienced pilots. (4) Anxiety scores for both subject groups were almost the same before training. The scores decreased after G-training for experienced pilots, but remained unchanged for pilot candidates. (5) The mean negative attitude scores of experienced and pilot candidates before the training were almost the same. However, the negative attitude scores of pilot candi-

dates after the training were significantly greater than those of the experienced pilots.

Author

*Gravitational Effects; Acceleration Stresses (Physiology); Physiological Acceleration; Blood Pressure; Physiological Responses; Pilot Training; Heart Rate; Centrifugal Force*

**19960020861**; 96N24384 Japanese Air Self-Defense Force, Tokyo, Japan

**Hormonal responses of students and instructor pilots during the initial phase of primary flight training course**

Otsuka, Yasutami, Japanese Air Self-Defense Force, Japan; Tarui, Hideo, Japanese Air Self-Defense Force, Japan; Kobayashi, Asao, Japanese Air Self-Defense Force, Japan; Kikukawa, Azusa, Japanese Air Self-Defense Force, Japan; Miyamoto, Yoshinori, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory, Vol. 36, No. 2; Jun. 1995, pp. 45-50; In Japanese; Also announced as 1996039350; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The levels of urinary catecholamine (CA) and salivary cortisol (Corti) in students and instructor pilots were determined during the initial phase of Primary Flight Training Course. The levels of CA were increased significantly after the flight in the students and the instructors. The changes in CA and Corti after the flight were greater in the students than in the instructors. The difference in CA and Corti responses between the students and the instructors might be caused by their flight experience.

Author

*Hormone Metabolisms; Physiological Responses; Catecholamine; Flight Training; Saliva*

**19960020862**; 96N24385 Japanese Air Self-Defense Force, Tokyo, Japan

**Electrogastrographic response to motion sickness**

Maruyama, Satoshi, Japanese Air Self-Defense Force, Japan; Kanamaru, Yoshiki, Japanese Air Self-Defense Force, Japan; Murakami, Shinichi, Japanese Air Self-Defense Force, Japan; Motohashi, Kiyoshi, Japanese Air Self-Defense Force, Japan; Osada, Hiroshi, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory, Vol. 36, No. 2; Jun. 1995, pp. 51-58; In Japanese; Also announced as 1996039350; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

To investigate relationship of the stomach movement to motion sickness, we studied frequency changes in cutaneous-recorded electrogastrograms (EGG) for four healthy subjects experiencing nausea induced by rotatory motion. Each subject was seated inside the gondola of GYROLAB which can expose the trainee to the spatial disorientation with yaw, pitch, and roll rotation as well as G-force by planetary movement. All of the subjects suffered nausea after head movement in the gondola with yaw rotation (90 deg/sec). The EGG frequency

rose from 3-4 cycles/min (cpm), observed in normal conditions, to 5-8 cpm. The EGG frequency were quickly recovered within 10 minutes after finishing rotation. EGG recording will be used as an effective objective index of motion sickness.

Author

*Motion Sickness; Rotation; Stomach; Rotating Environments; Flight Training; Physiological Responses; Gastrointestinal System*

**53**

**BEHAVIORAL SCIENCES**

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

**19960015824**; 96N21608 Boston Univ., Boston, MA USA  
**Neural Network Models of Eye Movement Control, Object Recognition, and Robot Navigation**

Aguilar-Pelaez, J. Mario, Boston Univ., USA, pp. 226; In English; No Copyright; Avail: Univ. Microfilms Order No. DA9512233, Hardcopy, Microfiche

This dissertation develops neural circuits within which two kinds of command sources are combined to provide adaptability and goal oriented control for eye movements, pattern recognition, and robot navigation. Two broad categories of command sources for control of action can be identified. Reactive commands are initiated by bottom-up signals arising from the sensors and/or preprocessing stages. Reactive commands resemble reflex commands but their generators may be much more complicated than a classical reflex arc. Planned commands are generated by top-down or feedback signals from higher level processing stages. The superior colliculus appears to be part of a final common path used for both reactive and planned saccadic eye movements. Current data on superior colliculus activity during eye movements show two distinct patterns. A neural network model is presented which shows how these patterns may emerge as a consequence of a neural design that enables reactive and planned commands to compete for movement resources. The model also shows how learning enables planned and reactive commands to interact within a consistent coordinate frame. Typical approaches to pattern learning and recognition are fundamentally reactive in that they assume that the input is preprocessed in its entirety before activating the recognition system. A neural network model is presented which utilizes planned commands to sequentially extract only those features that improve the discriminability between candidate recognition categories. Simulations show how a sequence of choices is made and processing halted when the confidence level for a category reaches a desired value. In order to maintain sensitivity to novelty, planned commands are supplemented by reactive commands that allow salient characteristics of the input to influence the next extraction operation. Common algorithmic approaches to robot navigation within dynamic

environments utilize a single high level planning stage which must be reengaged following each change in the environment. A neural network trajectory generator is introduced that combines planned commands with reactive commands in order to adapt to changes in the environment. Simulations of robot navigation through a cluttered 2-D environment show that the trajectory generator is a viable alternative to approaches with similar performance but much higher computational costs. Dissert. Abstr.

*Command And Control; Robot Dynamics; Neural Nets; Pattern Recognition; Robots; Saccadic Eye Movements; Robotics; Robot Control*

**19960015898**; 96N21671 Wisconsin Univ., Madison, WI USA

**Psychophysical Evaluation of Three-Dimensional Auditory Displays** *Annual Report, 1 May 1995 - 30 Apr. 1996* Wightman, Frederic L., Wisconsin Univ., USA; Apr. 1996, pp. 20; In English

Contract(s)/Grant(s): NCC2-542

Report No.(s): NASA-CR-200623; NAS 1.26:200623; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the progress made during the second year of a three-year Cooperative Research Agreement. The CRA proposed a program of applied psychophysical research designed to determine the requirements and limitations of three-dimensional (3-D) auditory display systems. These displays present synthesized stimuli to a pilot or virtual workstation operator that evoke auditory images at predetermined positions in space. The images can be either stationary or moving. In previous years, we completed a number of studies that provided data on listeners' abilities to localize stationary sound sources with 3-D displays. The current focus is on the use of 3-D displays in 'natural' listening conditions, which include listeners' head movements, moving sources, multiple sources and 'echoic' sources. The results of our research on one of these topics, the localization of multiple sources, was reported in the most recent Semi-Annual Progress Report (Appendix A). That same progress report described work on two related topics, the influence of a listener's a-priori knowledge of source characteristics and the discriminability of real and virtual sources. In the period since the last Progress Report we have conducted several new studies to evaluate the effectiveness of a new and simpler method for measuring the HRTF's that are used to synthesize virtual sources and have expanded our studies of multiple sources. The results of this research are described below.

Author

*Human Factors Engineering; Human-Computer Interface; Display Devices*

**19960017008**; 96N22614 Boston Univ., Boston, MA USA  
**Neural networks for vision and pattern recognition:**

### **Boundary completion, spatial mapping, and multidimensional data fusion**

Leshner, Gregory W., Boston Univ., USA; 1994, pp. 266; No Copyright; Avail: Univ. Microfilms Order No. DA9401999, Hardcopy, Microfiche

Human visual systems are designed to recognize objects in natural scenes and to understand spatial relations between scenic elements. Three essential computational processes include: construction of image boundaries, determination of spatial characteristics of objects, and fusion of multiple types of image data into recognition categories. A psychophysical experiment and three modeling studies - of a modified Boundary Contour System, a What-and-Where Filter, and a Fusion ARTMAP network - are carried out to better understand and emulate these processes. Study of the human visual system provides clues to design principles for artificial vision systems. In particular, illusory contours are visual percepts that highlight how human reconstruct incomplete or degraded boundaries. A psychophysical experiment was carried out that parametrically varies thickness and number of contour-inducing lines to achieve different levels of boundary completion. Illusory contour strength is shown to form an inverted-U with increasing number of lines, while strength increases to a plateau with increasing line width. These observations help constrain neural theories of boundary completion. The Boundary Contour System (BCS) provides a model of boundary completion. By exploring methods to ensure boundary signal activities remain sensitive to spatial variations of inducers, the BCS is further developed to model the results of the psychophysical experiment and related studies. The What-and-Where Filter generates a spatial map, in the Where channel, of an object's position, orientation, and size. This spatial map is used to generate an object representation, in the What channel, that is invariant under these characteristics for subsequent object recognition. Convolution with specialized filters of various orientations and sizes, followed by competition between filter outputs, determines the Where spatial characteristics. Gaussian interpolation and serial computation of spatial properties lead to a parsimonious design. Fusion ARTMAP is a supervised neural network that is capable of learning recognition categories and predictions in response to multi-dimensional input data. Data in each input channel are compressed into recognition categories before being fused into a final categorical prediction. Predictive errors trigger a parallel search that corrects the least confident channels first, thereby protecting effective channels from unnecessary recoding. Fewer memory resources are needed to achieve high predictive accuracy.

Dissert. Abstr.

*Neural Nets; Pattern Recognition; Optical Filters; Spatial Distribution; Multisensor Fusion; Computer Vision; Boundaries; Computer Aided Mapping; Human Factors Engineering; Artificial Intelligence; Machine Learning*

**19960017140**; 96N22733 NASA Marshall Space Flight Center, Huntsville, AL USA

**Preparing for the human factors/ergonomics job market**  
Shapiro, Ronald G., IBM Federal Systems Div., USA; Brown, Megan L., Thomson Consumer Electronics, France; Fogleman, Maxwell, Liberty Technology, USA; Goldberg, Joseph H., Pennsylvania State Univ., USA; Granda, Richard E., IBM Federal Systems Div., USA; Hale, Joseph P., II, NASA Marshall Space Flight Center, USA; Sanders, Elizabeth B.-N., Sanders Associates, Inc., USA; 1995, pp. 12; In English; 39th Annual Meeting of the Human Factors and Ergonomics Society, 9-13 Oct. 1995, San Diego, CA, USA

Report No.(s): NASA-TM-111352; NAS 1.15:111352; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The panel is designed to help an individual decide on a specialization in human factors/ergonomics and to prepare to enter the human factors job market. Panelists were selected to represent a cross-section of the field, and are from the following sectors: the electronics industry (Megan Brown), loss prevention research (Max Fogleman), academia (Joe Goldberg), the computer industry (Dick Granda), the government (Joe Hale), and consulting (Liz Sanders).

Author

*Human Resources; Personnel Development; Management Planning; Manpower*

**19960017240**; 96N22832 Armstrong Lab., Neuropsychiatry Branch., Brooks AFB, TX USA

**USAF Pilot Training Completion and Retention: A Ten Year Follow-Up on Psychological Testing Final Report, Dec. 1984 - Aug. 1995**

Retzlaff, Paul D., Armstrong Lab., USA; King, Raymond E., Armstrong Lab., USA; Callister, Joseph D., Armstrong Lab., USA; Aug. 1995, pp. 26; In English

Contract(s)/Grant(s): AF Proj. 7755

Report No.(s): AD-A300946; AL/AO-TR-1995-0124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A number of studies have examined the intelligence and personality of pilots. Few, however, have been able to utilize long term follow-up data. Three-hundred and fifty Air Force officers undergoing Undergraduate Pilot Training were administered the Multidimensional Aptitude Battery, the Personality Research Form, and the Million Clinical Multiaxial Inventory. Ten year follow-up data is provided on pilot training completion and length of service. No differences were found among the training completions groups but a number of consistent personality variables were correlated with length of service.

DTIC

*Pilot Training; Psychological Tests; Retention (Psychology); Pilots (Personnel)*

**19960017259**; 96N22851 Texas Univ., Dept. of Psychology., Austin, TX USA

**Crew Selection and Training Final Report**

Helmreich, Robert L., Texas Univ., USA; [1996], pp. 10; In English

Contract(s)/Grant(s): NCC2-286

Report No.(s): NASA-CR-200744; NAS 1.26:200744; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research addressed a number of issues relevant to the performance of teams in demanding environments. Initial work, conducted in the aviation analog environment, focused on developing new measures of performance related attitudes and behaviors. The attitude measures were used to assess acceptance of concepts related to effective teamwork and personal capabilities under stress. The behavioral measures were used to evaluate the effectiveness of flight crews operating in commercial aviation. Assessment of team issues in aviation led further to the evaluation and development of training to enhance team performance. Much of the work addressed evaluation of the effectiveness of such training, which has become known as Crew Resource Management (CRM). A second line of investigation was into personality characteristics that predict performance in challenging environments such as aviation and space. A third line of investigation of team performance grew out of the study of flight crews in different organizations. This led to the development of a theoretical model of crew performance that included not only individual attributes such as personality and ability, but also organizational and national culture. A final line of investigation involved beginning to assess whether the methodologies and measures developed for the aviation analog could be applied to another domain -- the performance of medical teams working in the operating room.

Derived from text

*Flight Crews; Human Performance; Teams; Personnel Selection; Training Evaluation; Performance Prediction*

**19960017321**; 96N22912 Maryland Univ., Computer Vision Lab., College Park, MD USA

**Three-D Model-Based Image Stabilization Using Multiple Visual Cues**

Yao, Y. S., Maryland Univ., USA; Burlina, P., Maryland Univ., USA; Chellappa, R., Maryland Univ., USA; Wu, T. H., Maryland Univ., USA; Jul. 1995, pp. 22; In English

Contract(s)/Grant(s): DAAH04-93-G-0419; ARPA Order A422

Report No.(s): AD-A300369; CAR-TR-781; CS-TR-3506; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Hardcopy, Microfiche

This paper studies the problem of image stabilization, defined here as the process of generating a compensated video sequence where image motion resulting from camera motion has been partially or totally removed. The scheme combines various visual cues such as points and horizon lines, and relies

on an Extended Kalman Filter for the estimation of parameters of interest. We study both calibrated and uncalibrated stabilization cases. We address the issues of local versus global stabilization. We consider the problem of the selection of dynamics for the estimation of warping parameters and illustrate the use of kinetic models for the selective removal of oscillatory motion. Experimental results from video sequences generated from off-road vehicle platforms show good performance of the stabilization schemes.

DTIC

*Image Motion Compensation; Stabilization; Visual Perception; Three Dimensional Models; Image Analysis; Imaging Techniques*

**19960017331**; 96N22922 California Univ., School of Optometry., Berkeley, CA USA

**Spatio-Temporal Masking in Human Vision and Its Application to Image Coding *Final Report***

Klein, Stanley, California Univ., USA; Silverstein, D. Amnon, California Univ., USA, pp. 3

Contract(s)/Grant(s): F49620-92-J-0359

Report No.(s): AD-A300556; AFOSR-TR-95-0693; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Before an image is stored or transmitted, we have access to the original and the distorted versions. The enhanced codec is compared to the original block by block to determine which blocks have been improved by the enhancement. These blocks are then flagged for post-processing in a way that is compliant with the JPEG standard and adds nothing to the compressed image's bandwidth. The end result is a compressed image that can be decompressed on any standard JPEG decompressor, but that can be enhanced by a sophisticated decompressor. For the comparison of the original and enhanced images, we have been developing a new vision model that is specifically tailored to the detection of errors that occur within or between two JPEG codec blocks. Previous filter models have been restricted from using a large number of filters due to computational constraints which we avoid by focusing the model on a tiny spatial area of 8x16 pixels. Further, features of human vision that have been included in previous models (color, temporal, stereo, etc.) are not needed for this more focused problem. Issues that have not been completely addressed by previous models, such as masking effects, are tractable and the model is more applicable to WEG compression.

DTIC

*Video Compression; Image Processing; Image Enhancement; Digital Techniques; Signal Encoding*

**19960017816**; 96N23341 National Aerospace Lab., Tokyo, Japan

**Effects of Visibility on Helicopter Pilot Performance. Part 2**

Funabiki, Kohei, National Aerospace Lab., Japan; Tanaka, Keiji, National Aerospace Lab., Japan; Kawahara, Hiroyasu,

National Aerospace Lab., Japan; Wakairo, Kaoru, National Aerospace Lab., Japan; Watanabe, Akira, National Aerospace Lab., Japan; Jun. 1995; ISSN 0389-4010, pp. 14; In Japanese Report No.(s): NAL-TR-1272; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A piloted flight simulation aiming at quantifying visibility effect on helicopter piloting was carried out. The flight simulation was conducted in the way of varying the visibility of the visual scene and the stability of the aircraft, respectively, so as to determine a critical value of the stability with which the pilot can barely control the aircraft. Eye fixation points data of the pilots were obtained in each visibility condition. The flight simulation results enabled direct evaluation of visibility effects upon pilot control performance in terms of helicopter stability. Some considerations of effectiveness of stability augmentation systems and display systems in low visibility condition are also described in this paper.

Author

*Helicopters; Pilot Performance; Flight Simulation; Low Visibility*

**19960018308**; 96N23636 Drexel Univ., Philadelphia, PA USA

**Cognitive maps of electronic information space**

Fitz, Philip E., Drexel Univ., USA; 1994, pp. 275; No Copyright; Avail: Univ. Microfilms Order No. DA9431166, Hardcopy, Microfiche

This thesis considers the problem of whether the same psychological processes used in navigating physical space can be used in navigating electronic information space. The navigation through hyperspace metaphor has gained wide usage, but there are no empirical links between the psychological literature on spatial navigation and navigation through electronic information space. If the underlying psychological processes are the same, the findings of the psychological literature on spatial navigation can be used to improve design of interfaces using the navigation metaphor. Subjects were asked to solve a figure matching task adapted from previous work. Two interfaces were developed to solve the task: one using a spatial navigation metaphor requiring subjects to move up, down, right and left through an information space, the other using a computer painting program metaphor to adjust attributes of a stationary figure. After the standard matching task was well-learned, two tests of cognitive maps taken from the psychological literature were given. One required the subjects to arrange cards to show their conceptualization of the task. The arrangements were rated as to the extent to which they showed a cognitive map of the information set. A second test for a cognitive map measured the subject's ability to handle detours to find an alternate path when the usual path was blocked. The test consisted of figure matching tasks where the usual solution was inactivated. The results showed the existence of a cognitive map for subjects using the spatial navigation interface. Those subjects did lay out the cards reflecting

the spatial arrangement of figures from the computerized figure matching task. The detour problems also showed the existence of cognitive maps in subjects using the spatial navigation interface based on (a) number, type and patterns of errors made, (b) average time to complete the trials, and (c) strategy differences between the two interface groups in solving detour problems. Taking the two tests together it was concluded that subjects can develop and use a spatially-based cognitive map in solving problems in electronic information space.

Dissert. Abstr.

*Computer Programs; Navigation; Strategy; Cognition; Human-Computer Interface*

**19960020417**; 96N23992 Washington Univ., Dept. of Psychology., Saint Louis, MO USA

**Blinks, Saccades, and Fixation Pauses During Vigilance Task Performance. Part 2: Gender and Time of Day Final Report**

Stern, John A., Washington Univ., USA; Boyer, Donna J., Washington Univ., USA; Schroeder, David J., Civil Aeromedical Inst., USA; Touchstone, R. Mark, Civil Aeromedical Inst., USA; Stoliarov, N., State Scientific Research Inst. for Civil Aviation, Russia; Mar. 1996, pp. 52; In English

Contract(s)/Grant(s): DTFA-02-91-C-91056

Report No.(s): DOT-FAA-AM-96/9; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As operators are required to spend more time monitoring computer controlled devices in future systems, it is critical to define the task and situational factors (i.e., fatigue) that may impact vigilance and performance. Aspects of the gaze system can be monitored relatively unobtrusively, although we used conventional electro-oculographic techniques in this study. Can gaze control measures be used to reflect, and hopefully predict, periods of impaired attention and performance? Gaze control measures (blinks, saccades, and fixations) were recorded while subjects performed an air traffic control simulation task. Twenty-five subjects performed the task for 3 days at 2 successive hours per day. Blinks and saccades were sampled for 5 consecutive minutes after 10, 30, 50, 70, 90, and 110 minutes of task performance. Significant Time-On-Task (TOT) effects were obtained for all of the 13 variables abstracted. A number of main effects for DAY and a number of interactions involving DAY were significant. TOT effects were obtained for blink rate, blink closing duration, 50% window, blink amplitude, long closure duration blinks, eye closure frequency, blink flurry frequency, number of blinks part of flurries, saccade rate, saccade amplitude, fixation duration, long duration fixations, and performance decrements. The changes in blink frequency and other blink attributes are interpreted within a framework suggesting a breakdown of inhibitory control as a function of TOT. We believe that this TOT effect is not a tonic one, i.e., a steady decline in the ability to inhibit, but a phasic process, in that periods of poorer inhibi-

tory control increase in frequency and duration as a function of TOT. This conceptual model is akin to one proposed by Bills (1931) dealing with performance 'blocks.' Performance declined as a function of TOT but improved over days of task performance. This improvement is mirrored by changes in blink parameters, suggesting that the task had become easier to perform.

Author

*Time Dependence; Human Performance; Alertness; Visual Tasks; Eye (Anatomy); Fatigue (Biology)*

**19960020428**; 96N24001 Federal Aviation Administration, Civil Aeromedical Inst., Oklahoma City, OK USA

**Some effects of 8- vs. 10-hour work schedules on the test performance/alertness of Air Traffic Control Specialists Final Report**

Schroeder, David J., Federal Aviation Administration, USA; Rosa, Roger R., National Inst. for Occupational Safety and Health, USA; Witt, L. Alan, National Inst. for Occupational Safety and Health, USA; Banks, Barnett, National Inst. for Occupational Safety and Health, USA, pp. 22; In English Report No.(s): DOT/FAA/AM-95/32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 10-hour, 4-day rotating shift schedule worked by some Air Traffic Control Specialists (ATCSs) was compared to the more traditional 8-hour, 2-21 rapidly rotating schedule. Measures of performance and alertness were obtained from a group of 52 ATCSs at an en route ATC center on tasks in the NIOSH fatigue test battery. Additional information on sleep patterns, mood, and somatic complaints was also gathered. Results confirm that tests comprising the NIOSH test battery are sensitive to fatigue and diurnal variations associated with a rotating shift schedule. Test performance of ATCSs on the 10-hour shift did not differ from those on the 8-hour schedule for any of the NIOSH parameters, when comparing the initial 4 days of the work week. Test performance was notably poorer on the mid-shift (night) that occurred on the final (fifth) day of the 2-2-1 8-hour schedule. For both schedules, there was evidence of changes in alertness on some of the NIOSH performance measures within work days and across days of the week. Changes in tests performance and mood ratings corresponded to the decline in self-reported sleep time across the work week.

Author

*Air Traffic Controllers (Personnel); Alertness; Schedules; Human Performance; Fatigue (Biology); Work-Rest Cycle*

**19960020634**; 96N24170 Kyushu Inst. of Tech., Fukuoka, Japan

**A new approach to construct a basic concept of human cognitive model based on subjective observation**

Shirahama, Naruki, Kyushu Inst. of Tech., Japan; Yoshida, Kaori, Kyushu Inst. of Tech., Japan; Yokoji, Seiji, Kyushu Inst. of Tech., Japan; Yanaru, Torao, Kyushu Inst. of Tech., Ja-

pan; IFSA 1995: Proceedings of the 6th International Fuzzy Systems Association World Congress; 1995, pp. 321-324; In English; Also announced as 1995005699; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

This paper introduces a basic concept of human cognitive model including emotional function. We show how to construct the model by computer simulation. At first, we explain the theory for Subjective Observation Model (SOM), which have high applicability to several kinds of fields especially on the emotional processing. The emotion we use here is based on Plutchik theory in the field of emotional psychology. Finally we show the attractive results by the computer simulation.

Author

*Emotional Factors; Cognitive Psychology; Human Factors Engineering; Cognition; Biological Models (Mathematics); Information Processing (Biology); Object-Oriented Programming*

**19960020838**; 96N24361 Japanese Air Self-Defense Force, Aeromedical Lab., Tokyo, Japan

**A Study on Evaluation of Flight Aptitude by Simulator**

Okaue, Miyako, Japanese Air Self-Defense Force, Japan; Nagatsuka, Kyouichi, Japanese Air Self-Defense Force, Japan; Kadoo, Atsushi, Japanese Air Self-Defense Force, Japan; Nishi, Syuji, Japanese Air Self-Defense Force, Japan; Katoh, Zoujirou, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory; Sep. 1994, pp. 45-56; In Japanese; Also announced as 1996037768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method to evaluate flying aptitude by using a flight simulator was attempted. In the method, a flight scenario was divided into 6 segments. Each segment began with straight level flight, followed by one or two kinds of simple maneuvers such as climbing turn, and ended with straight level flight. While the simulator was frozen before each segment, a subject sitting in the cockpit was instructed how to control the stick and the throttle by listening to the tape recorded before. The subject was also informed of the desirable pitch degree, roll degree and RPM percents for the control of each segment. Subjects were sixty-four JASDF flight student candidates. Their data were recorded and compared with scores of the flight test, which they had taken a few years ago to be evaluated for JASDF pilot training suitability by controlling aircraft during actual flying with a rater pilot. As the result, students with poorer flight test scores showed larger RMS errors for pitch and roll control than those with better scores. Multiple correlation coefficients between the simulator data and the flight test score were statistically significant. In conclusion, the method was considered to be effective as an alternative flight aptitude test, however, more studies on evaluation variables would be required.

Author

*Flight Tests; Flight Simulators; Lateral Control; Root-Mean-Square Errors; Aircraft Control; Longitudinal Control*

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**MAN/SYSTEM TECHNOLOGY  
AND LIFE SUPPORT**

*Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.*

**19960015691**; 96N21475 Ohio State Univ., Columbus, OH USA

**Strong, silent, and out-of-the-loop: Properties of advanced (cockpit) automation and their impact on human-automation interaction**

Sarter, Nadine Barbara, Ohio State Univ., USA, pp. 133; In English; No Copyright; Avail: Univ. Microfilms Order No. DA9517075, Hardcopy, Microfiche

In a variety of domains, the introduction of advanced automation technology has led to problems that are related to breakdowns in the communication and coordination between man and machine. One major difficulty is the failure of operators to track, anticipate, and understand the status and behavior of the automation -- a lack of situation or, more specifically, mode awareness which can lead to mode errors and 'automation surprises.' This lack of mode awareness is not an operator problem but rather the result of a mismatch between the capabilities and requirements of the human operator and the design of the automation. Changes in system design can therefore be expected to have an impact on the nature and severity of observed problems with man-machine cooperation. One of the areas where such changes rapidly evolve is the aviation domain. A current trend in the design of flight deck automation is increasing levels of system autonomy and authority which would require parallel improvements in feedback design to ensure system observability. To address the question of how properties of advanced automated systems affect the coordination between man and machine, a line of empirical research on pilot interaction with one of the most advanced automated aircraft currently in operation, the Airbus A-320, was conducted. A corpus of pilots' experiences with the operation of the Airbus A-320 automation was gathered. Line operations and transition training to the aircraft were observed. Based on the results of these activities, a simulation study of the coordination between pilots and the A-320 automation was carried out. The results of this research indicate that 'automation surprises' and mode errors still occur in the context of highly advanced automated systems. However, the nature of these problems has changed -- mode errors of omission have become more frequent where the operator fails to detect and intervene with undesired system behavior. This trend suggests that improvements in feedback design are

needed to support operators in keeping track of their increasingly 'strong and silent' machine counterparts.

Dissert. Abstr.

*Automatic Flight Control; Cockpits; Man Machine Systems; Pilot Performance; A-320 Aircraft; Pilot Error; Mental Performance; Aviation Psychology*

**19960016573**; 96N22217 Federal Aviation Administration, Civil Aeromedical Institute., Oklahoma City, OK USA

**Performance of a Continuous Flow Passenger Oxygen Mask at an Altitude of 40,000 Feet Final Report**

Garner, Robert P., Federal Aviation Administration, USA; Feb. 1996, pp. 16; In English

Report No.(s): DOT/FAA/AM-96/4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A redesigned continuous flow passenger oxygen mask was tested for its ability to deliver an adequate supply of oxygen at an altitude of 40,000 feet above sea level. Four male subjects participated in the study. Blood oxygen saturation (SaO<sub>2</sub>) baseline levels for hypoxic exposure were established for each subject. Immediately prior to high altitude exposure, subjects prebreathed 100% oxygen for two hours through a pressure demand type mask. The hypobaric chamber was then decompressed to a simulated altitude of 35,000 feet. Subjects switched to the passenger oxygen mask. The initial oxygen flow rate to the passenger mask came from manufacturer production performance test data. Once heart and respiratory rates and SaO<sub>2</sub> level stabilized, chamber altitude was increased to 40,000 feet. Descent to ground level was performed in steps of 5,000 feet with SaO<sub>2</sub> levels being established for each altitude and recommended oxygen flow. Subjects remained at each test altitude for a minimum of three minutes or until SaO<sub>2</sub> levels stabilized. At no point during the testing did SaO<sub>2</sub> levels approach baseline levels for hypoxic exposure. This mask design would appear to offer protection from hypoxia resulting from altitude exposure up to 40,000 feet.

Author

*Continuum Flow; Hypoxia; Oxygen Masks; High Altitude Breathing; Life Support Systems; Passengers*

**19960016584**; 96N22228 Hamilton Standard, Windsor Locks, CT USA

**Urine Pretreat Injection System Final Report**

Aug. 1995; pp. 127; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-199833; NAS 1.26:199833; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A new method of introducing the OXONE (Registered Trademark) Monopersulfate Compound for urine pretreat into a two-phase urine/air flow stream has been successfully tested and evaluated. The feasibility of this innovative method

has been established for purposes of providing a simple, convenient, and safe method of handling a chemical pretreat required for urine processing in a microgravity space environment. Also, the Oxone portion of the urine pretreat has demonstrated the following advantages during real time collection of 750 pounds of urine in a Space Station design two-phase urine Fan/Separator: Eliminated urine precipitate buildup on internal hardware and plumbing; Minimized odor from collected urine; and Virtually eliminated airborne bacteria. The urine pretreat, as presently defined for the Space Station program for proper downstream processing of urine, is a two-part chemical treatment of 5.0 grams of Oxone and 2.3 ml of H<sub>2</sub>SO<sub>4</sub> per liter of urine. This study program and test demonstrated only the addition of the proper ratio of Oxone into the urine collection system upstream of the Fan/Separator. This program was divided into the following three major tasks: (1) A trade study, to define and recommend the type of Oxone injection method to pursue further; (2) The design and fabrication of the selected method; and (3) A test program using high fidelity hardware and fresh urine to demonstrate the method feasibility. The trade study was conducted which included defining several methods for injecting Oxone in different forms into a urine system. Oxone was considered in a liquid, solid, paste and powdered form. The trade study and the resulting recommendation were presented at a trade study review held at Hamilton Standard on 24-25 October 94. An agreement was reached at the meeting to continue the solid tablet in a bag concept which included a series of tablets suspended in the urine/air flow stream. These Oxone tablets would slowly dissolve at a controlled rate providing the proper concentration in the collected urine. To implement the solid tablet in a bag approach, a design concept was completed with prototype drawings of the complete urine pretreat prefilter assembly. A successful fabrication technique was developed for retaining the Oxone tablets in a fabric casing attached to the end of the existing Space Station Waste Collection System urine prefilter assembly. The final pretreat prefilter configuration held sufficient Oxone in a tablet form to allow normal scheduled daily (or twice daily) change out of the urine filter depending on the use rate of the Space Station urine collection system. The actual tests to prove the concept were conducted using the Urine Fan/Separator assembly that was originally used in the STS-52 Design Test Objective (DTO) urinal assembly. Other related tests were conducted to demonstrate the actual minimum ratio of Oxone to urine that will control microbial growth.

Derived from text

*Urine; Space Processing; Sulfuric Acid; Waste Disposal; Waste Treatment; Chemical Cleaning; Chemical Fractionation; Potassium Compounds; Sulfates; Prototypes; Pretreatment; Fluid Injection*

**19960016594**; 96N22238 ION Electronics, Huntsville, AL USA

**PCR Based Microbial Monitor for Analysis of Recycled Water Aboard the ISSA: Issues and Prospects *Final Report, 1 Oct. 1994 - 15 Jun. 1995***

Cassell, Gail H., Alabama Univ., USA; Lefkowitz, Elliot J., Alabama Univ., USA; Glass, John I., Alabama Univ., USA, pp. 181; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-199835; NAS 1.26:199835; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The monitoring of spacecraft life support systems for the presence of health threatening microorganisms is paramount for crew well being and successful completion of missions. Development of technology to monitor spacecraft recycled water based on detection and identification of the genetic material of contaminating microorganisms and viruses would be a substantial improvement over current NASA plans to monitor recycled water samples that call for the use of conventional microbiology techniques which are slow, insensitive, and labor intensive. The union of the molecular biology techniques of DNA probe hybridization and polymerase chain reaction (PCR) offers a powerful method for the detection, identification, and quantification of microorganisms and viruses. This technology is theoretically capable of assaying samples in as little as two hours with specificity and sensitivity unmatched by any other method. A major advance in probe-hybridization/PCR has come about in a technology called TaqMan(TM), which was invented by Perkin Elmer. Instrumentation using TaqMan concepts is evolving towards devices that could meet NASA's needs of size, low power use, and simplicity of operation. The chemistry and molecular biology needed to utilize these probe-hybridization/PCR instruments must evolve in parallel with the hardware. The following issues of chemistry and biology must be addressed in developing a monitor: Early in the development of a PCR-based microbial monitor it will be necessary to decide how many and which organisms does the system need the capacity to detect. We propose a set of 17 different tests that would detect groups of bacteria and fungus, as well as specific eukaryotic parasites and viruses; In order to use the great sensitivity of PCR it will be necessary to concentrate water samples using filtration. If a lower limit of detection of 1 microorganism per 100 ml is required then the microbes in a 100 ml sample must be concentrated into a volume that can be added to a PCR assay; There are not likely to be contaminants in ISSA recycled water that would inhibit PCR resulting in false-negative results; The TaqMan PCR product detection system is the most promising method for developing a rapid, highly automated gene-based microbial monitoring system. The method is inherently quantitative. NASA and other government agencies have invested in other technologies that, although potentially could lead to revolutionary advances, are not likely to mature in the next 5 years into working systems; PCR-based

methods cannot distinguish between DNA or RNA of a viable microorganism and that of a non-viable organism. This may or may not be an important issue with reclaimed water on the ISSA. The recycling system probably damages the capacity of the genetic material of any bacteria or viruses killed during processing to serve as a template in a PCR designed to amplify a large segment of DNA (less than 650 base pairs). If necessary, vital dye staining could be used in addition to PCR, to enumerate the viable cells in a water sample; The quality control methods have been developed to insure that PCR's are working properly, and that reactions are not contaminated with PCR carryover products which could lead to the generation of false-positive results; and The sequences of the small rRNA subunit gene for a large number of microorganisms are known, and they constitute the best database for rational development of the oligonucleotide reagents that give PCR its great specificity. From those gene sequences, sets of oligonucleotide primers for PCR and Taqman detection that could be used in a NASA microbial monitor were constructed using computer based methods. In addition to space utilization, a microbial monitor will have tremendous terrestrial applications. Analysis of patient samples for microbial pathogens, testing industrial effluent for biofouling bacteria, and detection biological warfare agents on the battlefield are but a few of the diverse potential uses for this technology. Once fully developed, gene-based microbial monitors will become the fundamental tool in every lab that tests for microbial contaminants, and serve as a powerful weapon in mankind's war with the germ world.

Derived from text

*Polymer Chemistry; Assaying; Recycling; Water Pollution; Monitors; Life Support Systems; Deoxyribonucleic Acid; Spacecraft Equipment; Probes; Technology Assessment*

**19960016649**; 96N22274 Life Systems, Inc., Cleveland, OH USA

**Preliminary Design Program: Vapor Compression Distillation Flight Experiment Program *Final Report, Mar. 1994 - May 1995***

Schubert, F. H., Life Systems, Inc., USA; Boyda, R. B., Life Systems, Inc., USA; May 1995, pp. 64; In English

Contract(s)/Grant(s): NAS8-38250-11

Report No.(s): NASA-CR-199832; NAS 1.26:199832; TR-1738-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document provides a description of the results of a program to prepare a preliminary design of a flight experiment to demonstrate the function of a Vapor Compression Distillation (VCD) Wastewater Processor (WWP) in microgravity. This report describes the test sequence to be performed and the hardware, control/monitor instrumentation and software designs prepared to perform the defined tests. The purpose of the flight experiment is to significantly reduce the technical and programmatic risks associated with imple-

menting a VCD-based WWP on board the International Space Station Alpha.

Author

*Microgravity; Distillation Equipment; Water Reclamation; Spacecraft Environments; Waste Utilization; Closed Ecological Systems; Waste Water; Experiment Design*

**19960016683**; 96N22295 Galaxy Scientific Corp., Atlanta, GA USA

**Human factors in aviation maintenance: Phase 5 progress report Final Report, Apr. 1994 - Mar. 1995**

Shepherd, William T., Galaxy Scientific Corp., USA; Jan. 1996, pp. 298; In English

Contract(s)/Grant(s): DTFA01-94-C-01013

Report No.(s): DOT/FAA/AM-96/2; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The fifth phase of research on human factors in aviation maintenance continued to look at the human's role in the aviation maintenance system via investigations, demonstrations, and evaluations of the research program outputs. This report describes the following areas: (Ch. 2) PENS mobile computing software for FAA inspectors; (Ch. 3) STAR computer-based training for aviation regulations; (Ch. 4) HIS digital documentation systems, a hypertext multimedia software system; (Ch. 5) software/hardware distribution on the Internet; (Ch. 6) human factors program reviewing human performance issues associated with inspection; (Ch. 7) human factors audit program providing a valid tool for evaluating human factors in maintenance tasks; (Ch. 8) a study of how the design of workcards affects their use and the subsequent potential for error; (Ch. 9) the process of visual inspection and evaluation measuring visual inspection performance; (Ch. 10) a battery of mechanical aptitude tests, a simulated NDI task, and the ability of the tests to predict performance; (Ch. 11) the results of a report on an evaluation of a teamwork training program in a FAR 147 school; and (Ch. 12) ARAC rule changes and impending rule changes.

Author

*Human Factors Engineering; Aircraft Maintenance; Human Performance; Computer Programs; Computer Assisted Instruction; Training Evaluation; Aircraft Safety; Inspection; Civil Aviation*

**19960016936**; 96N22543 Defence Science and Technology Organisation, Materials Research Lab., Melbourne, Australia  
**An evaluation of marine biotechnology for atmosphere control in diesel-electric powered submarines**

Roe, Stephen P., Defence Science and Technology Organisation, Australia; 1994, pp. 4; Repr. from ECB6: Proceedings of the 6th European Congress on Biotechnology, 1994 p 1125-1127; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

From this evaluation, the preliminary results in use of marine microalgae and a photobioreactor confirm that this

biotechnology could possibly be applied to atmosphere revitalization in submarines. The determination of the most efficient algae for this application, together with the provision of sufficient photosynthetic active radiation (PAR) for photosynthesis of a CO<sub>2</sub>-enriched algae culture, within the limits of lamp efficiency and electrical energy allowance are the remaining concerns.

Derived from text

*Algae; Microorganisms; Bioreactors; Biotechnology; Controlled Atmospheres; Respiration; Human Factors Engineering; Oxygen Production*

**19960017281**; 96N22872 Colorado Univ., Dept. of Chemical Engineering., Boulder, CO USA

**Modeling, Monitoring and Fault Diagnosis of Spacecraft Air Contaminants Annual Report**

Ramirez, W. Fred, Colorado Univ., USA; Skliar, Mikhail, Colorado Univ., USA; Narayan, Anand, Colorado Univ., USA; Morgenthaler, George W., Colorado Univ., USA; Smith, Gerald J., Colorado Univ., USA; [1996], pp. 68; In English

Contract(s)/Grant(s): NAGw-4585

Report No.(s): NASA-CR-200748; NAS 1.26:200748; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Progress and results in the development of an integrated air quality modeling, monitoring, fault detection, and isolation system are presented. The focus was on development of distributed models of the air contaminants transport, the study of air quality monitoring techniques based on the model of transport process and on-line contaminant concentration measurements, and sensor placement. Different approaches to the modeling of spacecraft air contamination are discussed, and a three-dimensional distributed parameter air contaminant dispersion model applicable to both laminar and turbulent transport is proposed. A two-dimensional approximation of a full scale transport model is also proposed based on the spatial averaging of the three dimensional model over the least important space coordinate. A computer implementation of the transport model is considered and a detailed development of two- and three-dimensional models illustrated by contaminant transport simulation results is presented. The use of a well established Kalman filtering approach is suggested as a method for generating on-line contaminant concentration estimates based on both real time measurements and the model of contaminant transport process. It is shown that high computational requirements of the traditional Kalman filter can render difficult its real-time implementation for high-dimensional transport model and a novel implicit Kalman filtering algorithm is proposed which is shown to lead to an order of magnitude faster computer implementation in the case of air quality monitoring.

Derived from text

*Air Quality; Contaminants; Spacecraft Contamination; Indoor Air Pollution; Spacecraft Cabin Atmospheres; In-*

*Flight Monitoring; Pollution Transport; Gas Detectors; Pollution Monitoring*

**19960017302**; 96N22893 Army Research Lab., Aberdeen Proving Ground, MD USA

**Physical Fitness Training to Improve the Manual Material Handling Capability of Women *Annual Report, 23 Jan. - 1 Aug. 1995***

Knapik, Joseph, Army Research Lab., USA, pp. 38; In English

Contract(s)/Grant(s): MIPR-95MM5590

Report No.(s): AD-A301047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This annual report provides preliminary data on a study examining the influence of a combined resistance and aerobic training program on the manual material handling (MMH) capability and road marching performance of female soldiers, subjects were 21 female soldiers, 13 of which completed all phases of the investigation. They trained for 14 weeks, performing progressive resistance training 3 days per week, and running and interval training 2 days per week. Compared to values obtained before training, soldiers increased the maximum mass they could lift from floor to knuckle height by 19% (68 to 81 kg, p less than 0.001) and from floor to chest height by 16% (49 to 57 kg, p less than 0.001). They improved by 17% their ability to lift 15 kg as many times as possible in 10-min (167 to 195 lifts, p less than 0.001). They improved by 4% their maximal effort road march time over a 5 km distance, carrying a 23-kg load mass (44.7 to 43.1 min, p-0.02). Data analysis is still ongoing. These preliminary findings indicate that a short term physical fitness program, conducted about 1 hour per day, 5 days per week can substantially improve female soldier's MMH capability and can result in a small improvement in road marching ability.

DTIC

*Females; Physical Fitness; Materials Handling; Aerobes*

**19960017329**; 96N22920 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Effects of Head Supported Devices on Pilot Performance During Simulated Helicopter Rides *Final Report***

Alem, Nabih M., Army Aeromedical Research Lab., USA; Meyer, Martin D., Old Dominion Univ., USA; Albano, John P., Army Aeromedical Research Lab., USA; Sep. 1995, pp. 17 Report No.(s): AD-A300600; USAARL-95-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Effects of helmet weight moments on helicopter pilot fatigue and performance during extended missions were evaluated in a study in which 12 volunteer subjects were exposed to random vibrations in 4-hour sessions while wearing various helmet configurations. One of the objectives of the study was to investigate an upper limit criterion of 83 N cm for the weight moment of head-worn devices previously proposed by Butler (1992). In this study, four helmet configurations, hav-

ing weight moments of 20, 110, 200, and 290 N cm, were tested with each subject. Detection and acquisition of visual targets, a task often performed by AH-64 helicopter pilots, were simulated by requiring the subject to aim a light beam, emanating from a helmet-attached source, at light emitting diodes (LED) which were lit at random. Vigilance of the subject was measured by the duration the LED remained lit before it was turned off by the subject. Analysis of this vigilance data did not reveal a consistent relationship between exposure duration and performance. However, the vigilance data clearly demonstrated pilot performance degraded as the weight moment of the helmet increased, and that acquisition times were shortest for weight moments of about 78 N cm.

DTIC

*Ah-64 Helicopter; Pilot Performance; Random Vibration; Helmets; Flight Fatigue*

**19960017362**; 96N22953 Army Research Lab., Aberdeen Proving Ground, MD USA

**Investigation of Female Load-Carrying Performance *Annual Report, 23 Jan. - 1 Aug. 1995***

Harper, William H., Army Research Lab., USA; Knapik, Joseph, Army Research Lab., USA, pp. 52

Contract(s)/Grant(s): MIPR-95MM5589

Report No.(s): AD-A301048; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

While many studies have examined the physiological, biomechanical, and medical effects of load carrying on male subjects, those studies examining female subjects are limited. There are no data comparing male and female differences in maximal effort road-marching performance for militarily relevant distances. This study will investigate female and male load carriage performance. Subjects carry total loads of 40, 60, and 80 pounds for a distance of 10 km at a maximal pace. Times to complete the march as well as intermediate times at the 2.5-km, 5.0-km, and 7.5-km checkpoints will be recorded. Also, the effect of the loaded march on other tasks of military interest will be evaluated. Pre- and post-march measures of grenade throw for distance and vertical jump will be evaluated to determine the effects of the loaded marches on the performance of these tasks. Heart rate data and oxygen consumption data will be collected and examined to determine the effects of the road march and various loads on these factors. Data collection will begin in August 1995.

DTIC

*Data Acquisition; Females; Males; Physiological Effects; Stress (Physiology)*

**19960017565**; 96N23144 United Technologies Corp., Windsor Locks, CT USA

**SPE (trademark) Oxygen Generator Assembly (OGA). (Refurbishment of the technology demonstrator LFSPE oxygen generation subsystem) *Final Report***

Roy, Robert J., United Technologies Corp., USA; Jul. 1995, pp. 222; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-200699; NAS 1.26:200699; SPEOGA-38250-23FR; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The SPE Oxygen Generator Assembly (OGA) has been modified to correct operational deficiencies present in the original system, and to effect changes to the system hardware and software such that its operating conditions are consistent with the latest configuration requirements for the International Space Station Alpha (ISSA). The effectiveness of these changes has recently been verified through a comprehensive test program which saw the SPE OGA operate for over 740 hours at various test conditions, including over 690 hours, or approximately 460 cycles, simulating the orbit of the space station. This report documents the changes made to the SPE OGA, presents and discusses the test results from the acceptance test program, and provides recommendations for additional development activities pertinent to evolution of the SPE OGA to a flight configuration. Copies of the test data from the acceptance test program are provided with this report on 3.5 inch diskettes in self-extracting archive files.

Author

*Life Support Systems; Oxygen Supply Equipment; Spacecraft Cabin Atmospheres; Performance Tests; Oxygen Production*

**19960017579**; 96N23158 Federal Aviation Administration, Civil Aeromedical Inst., Oklahoma City, OK USA

**Determination of Effective Thoracic Mass**

Marcus, Jeffrey H., Federal Aviation Administration, USA; Feb. 1996, pp. 40; In English

Report No.(s): DOT/FAA/AM-96/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Effective thoracic mass is a critical parameter in specifying mathematical and mechanical models (such as crash dummies) of humans exposed to impact conditions. A method is developed using a numerical optimizer to determine effective thoracic mass (and mass distribution) given a number of acceleration signals and a force signal response. Utilizing previously reported lateral and frontal tests with human cadaveric test specimens in a number of different conditions, the effective thoracic mass is computed. The effective thoracic masses are then computed for a variety of crash dummies exposed to identical test conditions. The force responses generated using the computed effective thoracic masses are compared to the actual measured force responses. The thoracic mass of the crash dummies is then compared to the values for human cadaveric subjects. The distribution of thoracic mass is found to be a function of test condition. The implications in terms of mathematical model development, crash dummy design, and the appropriateness of various types of tests (e.g. pendulum vs. sled) are discussed.

Author

*Dummies; Mass Distribution; Biological Models (Mathematics); Thorax; Biodynamics; Body Weight; Human Body; Impact Tests*

**19960017611**; 96N23168 Battelle Columbus Labs., OH USA

**Spacelab Charcoal Analyses Final Report**

Slivon, L. E., Battelle Columbus Labs., USA; Hernon-Kenny, L. A., Battelle Columbus Labs., USA; Katona, V. R., Battelle Columbus Labs., USA; Dejarne, L. E., Battelle Columbus Labs., USA, pp. 100; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-200776; NAS 1.26:200776; ION8-38250-14FR; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This report describes analytical methods and results obtained from chemical analysis of 31 charcoal samples in five sets. Each set was obtained from a single scrubber used to filter ambient air on board a Spacelab mission. Analysis of the charcoal samples was conducted by thermal desorption followed by gas chromatography/mass spectrometry (GC/MS). All samples were analyzed using identical methods. The method used for these analyses was able to detect compounds independent of their polarity or volatility. In addition to the charcoal samples, analyses of three Environmental Control and Life Support System (ECLSS) water samples were conducted specifically for trimethylamine.

Derived from text

*Charcoal; Gas Chromatography; Life Support Systems; Mass Spectroscopy; Spacelab; Air Filters; Waste Water*

**19960017612**; 96N23169 Michigan Technological Univ., Depts. of Chemical and Civil/Environmental Engineering., Houghton, MI USA

**VRA Modeling, phase 1 Final Report**

Kindt, Louis M., Michigan Technological Univ., USA; Mullins, Michael E., Michigan Technological Univ., USA; Hand, David W., Michigan Technological Univ., USA; Kline, Andrew A., Michigan Technological Univ., USA, pp. 118; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-200698; NAS 1.26:200698; ION8-38250-18FR; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The destruction of organic contaminants in waste water for closed systems, such as that of Space Station, is crucial due to the need for recycling the waste water. A co-current upflow bubble column using oxygen as the gas phase oxidant and packed with catalyst particles consisting of a noble metal on an alumina substrate is being developed for this process. The objective of this study is to develop a plug-flow model that will predict the performance of this three phase reactor system in destroying a multicomponent mixture of organic contaminants in water. Mass balances on a series of contaminants and

oxygen in both the liquid and gas phases are used to develop this model. These mass balances incorporate the gas-to-liquid and liquid-to-particle mass transfer coefficients, the catalyst effectiveness factor, and intrinsic reaction rate. To validate this model, a bench scale reactor has been tested at Michigan Technological University at elevated pressures (50-83 psig.) and a temperature range of 200 to 290 F. Feeds consisting of five dilute solutions of ethanol (approx. 10 ppm), chlorobenzene (approx. 20 ppb), formaldehyde (approx. 100 ppb), dimethyl sulfoxide (DMSO approx. 300 ppb), and urea (approx. 20 ppm) in water were tested individually with an oxygen mass flow rate of 0.009 lb/h. The results from these individual tests were used to develop the kinetic parameter inputs necessary for the computer model. The computer simulated results are compared to the experimental data obtained for all 5 components run in a mixture on the differential test column for a range of reactor contact times.

Author

*Waste Water; Closed Ecological Systems; Contaminants; Mass Transfer; Mass Flow Rate; Oxygen; Computerized Simulation; Spacecraft Environments; Vapor Phases; Liquid Phases; Water Reclamation*

**19960017620**; 96N23177 Alpha Technology, Huntsville, AL USA

**Generic Health Management: A System Engineering Process Handbook Overview and Process Final Report, 18 May - 15 Dec. 1995**

Wilson, Moses Lee, Alpha Technology, USA; Spruill, Jim, Alpha Technology, USA; Hong, Yin Paw, Alpha Technology, USA, pp. 75; In English

Contract(s)/Grant(s): NAS8-40365

Report No.(s): NASA-CR-200701; NAS 1.26:200701; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Health Management, a System Engineering Process, is one of those processes-techniques-and-technologies used to define, design, analyze, build, verify, and operate a system from the viewpoint of preventing, or minimizing, the effects of failure or degradation. It supports all ground and flight elements during manufacturing, refurbishment, integration, and operation through combined use of hardware, software, and personnel. This document will integrate Health Management Processes (six phases) into five phases in such a manner that it is never a stand alone task/effort which separately defines independent work functions.

Derived from text

*Systems Health Monitoring; Management Systems; Flight Instruments; Spacecraft Instruments; Handbooks; Fault Detection*

**19960017621**; 96N23178 Alpha Technology, Huntsville, AL USA

**SSFF Health Management Analysis Report. Part 2: Proof**

**of Concept Final Report, 18 May - 15 Dec. 1995**

Wilson, L., Alpha Technology, USA; Spruill, J., Alpha Technology, USA; Hong, Y., Alpha Technology, USA, pp. 55; In English

Contract(s)/Grant(s): NAS8-40365

Report No.(s): NASA-CR-200702; NAS 1.26:200702; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this Proof of Concept analysis on SSFF Health Management the following area was described: the Gas Distribution Subsystem (GDS) was studied and evaluated utilizing the PDR Configuration and with respect to the design features encompassing Health Management (HM) aspects outlined in the Generic Handbook. From the results of this study, it was found that there is a definite need for coordinating measurements within and between the subsystems that will ensure that Functional Failures are properly revealed and substantiated as valid by other measurements, even those from other interfacing subsystems.

Derived from text

*Systems Health Monitoring; Systems Management; Systems Analysis; Management Analysis; Gaseous Diffusion; Computer Systems Design; Assessments*

**19960017622**; 96N23179 United Technologies Corp., Windsor Locks, CT USA

**Space Station Water Processor Mostly Liquid Separator (MLS) Final Report**

Lanzarone, Anthony, United Technologies Corp., USA, pp. 93; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-199838; NAS 1.26:199838; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report presents the results of the development testing conducted under this contract to the Space Station Water Processor (WP) Mostly Liquid Separator (MLS). The MLS units built and modified during this testing demonstrated acceptable air/water separation results in a variety of water conditions with inlet flow rates ranging from 60 - 960 LB/hr.

Author

*Separators; Space Stations; Water; Water Reclamation*

**19960017630**; 96N23186 Life Systems, Inc., Cleveland, OH USA

**Enhanced Urine Ersatz Development and Testing Final Report**

Andras, M. T., Life Systems, Inc., USA; Schubert, F. H., Life Systems, Inc., USA; Aug. 1995, pp. 42; In English

Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-200696; NAS 1.26:200696; TR-1738-43; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A urine Ersatz is developed to a state of readiness which can support the planned Vapor Compression Distillation

Wastewater Processor Flight Experiment and extended earth-based characterization testing.

Derived from text

*Urine; Performance Tests; Synthesis; Vapor Pressure; Interfacial Tension*

**19960018146**; 96N23576 Drexel Univ., Philadelphia, PA USA

**Biped locomotion on irregular terrain**

McCown-McClintick, Barbara Ellen, Drexel Univ., USA; 1994, pp. 178; In English; No Copyright; Avail: Univ. Microfilms Order No. DA9427422, Hardcopy, Microfiche

Biped locomotion on irregular terrain was studied with computer simulations of two and three dimensional bipeds with hip and knee joints the dynamic models included all of the nonlinear terms in the equations of motion. The three dimensional motion consisted of body torsional motion about the biped vertical axis. A walking gait, named the 'Quad' gait, was defined with a combination of linear and quadratic constraint equations that defined the biped joint motion. Locomotion was studied on a variety of rigid surfaces, including sloped, sinusoidal, surfaces with randomized irregularities, and a ground surface defined by a chaotic form of the Duffing's equation. Variations in the gait and body torsional motion, as well as biped system perturbations, were used to study gait stability. It was found that the Quad gait had the potential to be used as a basic gait for locomotion over a wide variety of surfaces. There were certain gait features, such as the phasing of the knee constraint and the body torsional motion, that could be utilized to enhance the biped systems; stability and efficiency. The biped model and the ground surface must both be considered to be a part of the dynamical system, as the biped response mirrors the characteristics of the environment that it traverses. Thus it is of great importance to define the ground surface carefully in studies of biped locomotion, in order to fully understand and appreciate the behavior of the biped system.

Dissert. Abstr.

*Dynamic Models; Three Dimensional Motion; Walking; Irregularities; Terrain; Computerized Simulation; Two Dimensional Models; Three Dimensional Models; Equations Of Motion*

**19960018289**; 96N23617 University of Southern California, Los Angeles, CA USA

**Modeling, design and evaluation of advanced teleoperator control systems with time delay**

Lee, Hahk Sung, University of Southern California, USA; 1992, pp. 0; In English; No Copyright; Avail: Issuing Activity (Micrographics Dept., Doheny Library, USC, Los Angeles, CA 90089-0182), Hardcopy, Microfiche

An advanced teleoperator control system should be designed with consideration of human dynamics in the control loop, and the designed control systems should support a

proper coordination between the operator and the manipulator so that it can achieve its control objectives under shared control and communication time delay. moreover, the control system should minimize operator's control effort or burden by utilizing dexterous manipulators and autonomous systems to their fullest capacity. Previous teleoperator control systems developed based on telepresence or passivity may not meet the above design goals. This is because: (1) most control systems have been designed without the consideration of human dynamic behavior which is crucial in determining overall control performance and system stability; (2) the concept of telepresence is obscure under communication time delay; and (3) under the compliance/force control performed by the remote manipulator under shared control, the previous kinesthetic coupling between man and machine may bring confusion into human decision-making during operation. This thesis presents a novel advanced teleoperator control system that meets the aforementioned design goals by introducing the concept of telemonitoring. In designing an advanced teleoperator control system, we consider the following essential factors that affect the system performance and stability: (1) the manipulator control algorithm; (2) the human dynamic behavior in teleoperation; (3) the dynamic coordination between two (control and remote) stations; and (4) the optimal design strategy of robustness/performance. For a high quality manipulator control, generalized impedance control is developed as the control strategy. Then, the dynamic characteristics of manipulators are actively modified for more desirable behavior within the frame work of the generalized impedance control. The human dynamic behavior involved in teleoperation is modeled and incorporated into the controller design and evaluation. The concept of telemonitoring is proposed for a concerted coordination between man-machine, in which the kinesthetic coupling is provided for the operator to monitor the control performance of the manipulator using monitoring force feedback. The proposed teleoperator control system has been simulated and compared with a number of conventional methods under the presence of human control errors and time delays. Results show that the proposed control system provides superior performance in terms of error profiles and task completion time under the existence of a wide range of time delay and human control errors.

Dissert. Abstr.

*Teleoperators; Human Factors Engineering; Man Machine Systems; Telerobotics; Manipulators; Remote Manipulator System; Systems Engineering; Control Systems Design; Mathematical Models; Time Lag; Decision Making*

**19960018422**; 96N23748 Saskatchewan Univ., Saskatoon, Saskatchewan Canada

**First sight: Towards a system in human body motion recognition and understanding**

Leung, Maylor Karhang, Saskatchewan Univ., Canada; 1992, pp. 265; In English; ISBN-0-315-82981-8; No Copyright;

Avail: Univ. Microfilms Order No. DANN82981, Hardcopy, Microfiche

The goal of human body motion analysis is to use a computer to understand human body motion recorded in a sequence of frames. In the analysis, only the moving parts are of interest. Many methods have been proposed but few give practical or general solutions because the human body is a highly complex structure which can twist, bend, and rotate. Other complexities, such as the frequent occlusion of one part of the body by the other, complicate both the segmentation and analysis processes. The work done in this area has been focused on either the high or the low level leaving many gaps in between unsolved. Research at the high level frequently assumes that the images can be well segmented and a medium level description of the human figure, e.g. a stick figure, can be obtained. The low level process is bypassed explicitly or manually by locating the feature points on a human body, or by using simulated data. There are two problems with this approach. First, it is well known that to obtain a well segmented picture in general is still an open problem. Second, to assume that the needed medium level description of a human body can be obtained is difficult to justify. On the other hand, researchers at the low level often neglect the requirements of the high level processes. In addition, the outputs from the low level processes are not perfect. It is neither known nor mentioned how the imperfect outputs can be handled by the high level processes. Hence, researchers at the high level appear to avoid using the results from the low level research. The design of a plausible human motion analysis system should encompass both the high level as well as the low level processes in a coherent manner. The objective of this study is to design and implement such a system, named First Sight. There are two major objectives in this area of research: (1) to recover the object skeleton structure and (2) to interpret and analyse the motion performed by the actor. In this study, methods are proposed to handle the first objective. The second problem is beyond the scope of this study.

Dissert. Abstr.

*Human Body; Motion; Musculoskeletal System*

**19960020427**; 96N24000 NASA Lewis Research Center, Cleveland, OH USA

### **Stress and Reliability Analysis of a Metal-Ceramic Dental Crown**

Anusavice, Kenneth J, Florida Univ., USA; Sokolowski, Todd M., Ohio State Univ., USA; Hojjatie, Barry, Florida Univ., USA; Nemeth, Noel N., NASA Lewis Research Center, USA; Mar. 1996, pp. 24; In English; ANSYS Conference and Exhibition, 20-22 May 1996, Pittsburg, PA, USA; Sponsored by ANSYS, Inc., USA

Contract(s)/Grant(s): RTOP 505-63-5B

Report No.(s): NASA-TM-107178; E-10141; NAS 1.15: 107178; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interaction of mechanical and thermal stresses with the flaws and microcracks within the ceramic region of metal-ceramic dental crowns can result in catastrophic or delayed failure of these restorations. The objective of this study was to determine the combined influence of induced functional stresses and pre-existing flaws and microcracks on the time-dependent probability of failure of a metal-ceramic molar crown. A three-dimensional finite element model of a porcelain fused-to-metal (PFM) molar crown was developed using the ANSYS finite element program. The crown consisted of a body porcelain, opaque porcelain, and a metal substrate. The model had a 300 Newton load applied perpendicular to one cusp, a load of 300N applied at 30 degrees from the perpendicular load case, directed toward the center, and a 600 Newton vertical load. Ceramic specimens were subjected to a biaxial flexure test and the load-to-failure of each specimen was measured. The results of the finite element stress analysis and the flexure tests were incorporated in the NASA developed CARES/LIFE program to determine the Weibull and fatigue parameters and time-dependent fracture reliability of the PFM crown. CARES/LIFE calculates the time-dependent reliability of monolithic ceramic components subjected to thermomechanical and/or proof test loading. This program is an extension of the CARES (Ceramics Analysis and Reliability Evaluation of Structures) computer program.

Author

*Reliability Analysis; Stress Analysis; Ceramics; Porcelain; Teeth; Applications Programs (Computers); Performance Prediction; Cracking (Fracturing)*

**19960020525**; 96N24074 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

### **Advanced Oxygen Systems for Aircraft *Systemes d'Oxygene Avances***

Ernsting, John, Editor, Royal Air Force, UK; Miller, Richard L., Editor, Armstrong Lab., USA; Apr. 1996, pp. 112; In English

Report No.(s): AGARD-AG-286; ISBN-92-836-1033-4; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

Many of the oxygen systems fitted to present NATO aircraft are unsatisfactory as they employ liquid oxygen which requires a complex and expensive supply chain, they impose undesirable physiological loads on the aircrew, particularly high resistance to breathing, and they do not provide pressure breathing with +Gz or effective protection to the respiratory tract and eyes against NBC agents. Advanced Oxygen Systems (AOS), which provide on board generation of breathing gas, impose a low physiological load on the aircrew and provide pressure breathing with G and at high altitude and protection against NBC agents, are required in the new generation of very agile high performance combat aircraft now under development by the NATO nations. This monograph provides a comprehensive review of the present state of development

of AOS for combat aircraft and provides practical guidelines for the future development of these systems. The monograph comprises an introduction; conventional US and UK oxygen systems and their deficiencies; the history of development of on-board oxygen generating systems, OBOGS; operational requirements and design of AOS; physiological requirements for AOS; molecular sieves, pressure swing adsorption and oxygen concentrators; breathing gas regulators and masks for AOS; current molecular sieve oxygen generation systems; sensors, indicators and controls for AOS; practical aspects of design of AOS; and effects of contaminants, including chemical warfare agents, on molecular sieve oxygen generators; and an index. This monograph will be of value to all those concerned with the design, procurement and operational use of Advanced Oxygen Systems to be fitted to future high performance combat aircraft.

Author

*Life Support Systems; Breathing Apparatus; Fighter Aircraft; Pressure Breathing; Supersonic Aircraft; Oxygen Masks; High Altitude Breathing; Acceleration Protection*

**19960020633**; 96N24169 Bordeaux 2 Univ., France

**A fuzzy algorithm selecting sportsmen for a particular sportive profile from fuzzy anthropometric characteristics**

Cazenave, Michel-Bernard, Bordeaux 2 Univ., France; Deliac, Philippe, Bordeaux 2 Univ., France; Salamon, Roger, Bordeaux 2 Univ., France; IFSA 1995: Proceedings of the 6th International Fuzzy Systems Association World Congress; 1995, pp. 285-288; In English; Also announced as 1995005699; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

We analyzed a sample of 926 sportsmen. They practiced a wide variety of sports, some competed regularly, others in their leisure hours. Each of the sportsmen is classified by nine anthropometric characteristics. The question we pose is: how do we go about the matching of these subjects to the anthropometric profiles defined from two sports categories, namely soccer players (160) and rugby players (156). To answer this question, we present a fuzzy method that matches each of the sportsmen to the appropriate profile and discuss the choices we were faced with in the development of the algorithm for this. It was found that the higher the matching of any subject to the profile, the higher his membership value.

Author

*Fuzzy Systems; Algorithms; Anthropometry; Athletes; Profiles; Morphology*

**19960020715**; 96N24238 Jackson State Univ., Technology Dept., Jackson, MS USA

**Advanced Payload Transfer Measurement System (APT-MS) Mechanical Features**

Brewer, William V., Jackson State Univ., USA; The 1995 Research Reports: NASA/ASEE Summer Faculty Fellowship Programs; Nov. 1995, pp. 25-50; In English; Also

announced as 1996007740; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

During the last two feet or so of transfer, for a large or heavy payload to its restraining fixture, the consequences of unplanned contact (or impact) between payload and support structure can range from merely annoying to something approaching disaster. Current transfer methods employ technicians with meter sticks stationed at the various hold-down locations to estimate the distances to contact. This information is communicated orally to the crane operator. It is understandable that this work proceeds carefully and therefore slowly. The objectives of this study are (1) to explore mechanical sources of measurement error; and (2) to develop an improved prototype design that is compact, inexpensive, and addresses the measurement error issues. APT is a relatively inexpensive electro-mechanical device that reduces both time and manpower required to make shuttle payload transfers. APT measurement system would provide a GUI for the 'move-conductor' (crane operator) so he could see the displacements of all hold-down interfaces as they move together and thus have a more accurate, comprehensive and 'real-time' picture of the engagement activity. An error model attempts to include all estimatable sources of mechanical error and design features were introduced to reduce or eliminate major sources of error.

Author

*Electromechanical Devices; Fixtures; Payload Transfer; Space Shuttle Payloads; Functional Design Specifications*

**19960020840**; 96N24363 Japanese Air Self-Defense Force, Aeromedical Lab., Tokyo, Japan

**Reading Time of EFIS (Electrical Flight Instrument System) by Using Eye Mark Recorder**

Nishi, Shuji, Japanese Air Self-Defense Force, Japan; Kadoo, Atsushi, Japanese Air Self-Defense Force, Japan; The Reports of Aeromedical Laboratory; Sep. 1994, pp. 63-75; In Japanese; In English; Also announced as 1996037768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The EFIS (Electrical Flight Instrument System) format-programmable displays are equipped with in the flight simulator POWERS (Pilot's Operational Workload Evaluation Research Simulator). Display formats of the EFIS were evaluated for reading time by using Eye Mark Recorder. The EFIS could display 5 digit digital or 3 moving pointers analog altimeter, 3 digit digital or moving single pointer analog airspeed indicator, and 3 digit digital or fixed single pointer analog heading indicator. The purpose of this research is a comparison of reading times of flight instrument among several display formats: digital to analog, large size (7mm high) to small size (4mm high) of digits, number of digits, fixed pointer to moving pointer and single pointer to multi pointers. The results were as follows: (1) The digital indicators showed shorter reading times than analog indicators; (2) The character size of digit, 4 millimeter by 1.2 millimeter vs. 7 millimeter

by 4 millimeter, did not affect reading times; (3) The 3 digits indicator showed shorter reading times than the 5 digits indicator; (4) The difference between fixed pointer and moving pointer indicators did not affect reading times; (5) The multi pointer indicator showed longer reading times than the single pointer indicator; and (6) The factor of individual differences of subjects did affect reading times.

Author

*Flight Instruments; Flight Simulators; Reading; Display Devices*

**19960021248**; 96N23160 Life Systems, Inc., Cleveland, OH USA

**Preliminary Design Program: Static Feed Electrolyzer Flight Experiment Program Final Report, 2 May 1994 - 31 May 1995**

Schubert, Franz H., Life Systems, Inc., USA; Boyda, Robert B., Life Systems, Inc., USA; May 1995, pp. 66; In English  
Contract(s)/Grant(s): NAS8-38250

Report No.(s): NASA-CR-200778; NAS 1.26:200778; TR-1723-20; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document provides a description of the results of a program to prepare a Preliminary Design of a Flight to demonstrate the function of a Static Feed Electrolyzer (SFE) in microgravity. This report describes the test sequence to be performed and the hardware, control/monitor instrumentation and software designs prepared to perform the defined tests. The purpose of the Flight Experiment is to significantly reduce the technical and programmatic risks associated with implementing a SFE based Oxygen Generator on board the International Space Station Alpha.

Author

*Experiment Design; Oxygen Production; Oxygen Supply Equipment; Electrolysis; Microgravity; Life Support Systems; Electrolytic Cells; Spacecraft Cabin Atmospheres*

## 55 SPACE BIOLOGY

*Includes exobiology; planetary biology; and extraterrestrial life.*

**19960020485**; 96N24057 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

**Supporting Research and Technology Activities for a Microwave Observing Program to Search for Extraterrestrial Intelligence Final Report, 1 Oct. 1993 - 30 Sep. 1995**

Tarter, Jill, Search for Extraterrestrial Intelligence Inst., USA; Backus, Peter, Search for Extraterrestrial Intelligence Inst., USA; Sep. 1995, pp. 30; In English  
Contract(s)/Grant(s): NCC2-336

Report No.(s): NASA-CR-200844; NAS 1.26:200844; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Curriculum materials based on the search for extraterrestrial intelligence (SETI) were developed for grades 3 through 9 science classes. The project was supported in part by NASA. Six teacher's guides, plus ancillary visuals, addressing topics in astronomy, biology, chemistry, geosciences, and physics as well as mathematics, social sciences, and language arts, were designed by a team of teachers, scientists, curriculum developers, and artists. First drafts were piloted by 10 design team teachers; revised drafts were field tested by 109 teachers in 30 states. Extensive feedback from these teachers and their students and reviews by scientists were used to revise materials prior to submission to the publisher. The field test teachers overall ranking of all guides (data from individual lesson feedback forms) was 431 on a one low to five high scale; 85% found the content appropriate to course and grade level and 75% indicated they had no reservations about using the materials again or recommending them to colleagues. The ratio of liked to disliked student responses (from 1305 student letters) was 70:30. Most recommendations from the teachers, students, and science reviewers were incorporated in the final versions for the guides, published by Libraries Unlimited/Teacher Ideas Press, 1995.

Derived from text

*Project Seti; Microwaves; Education; Students*

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