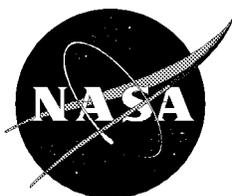


NASA/SP—2000-7011/SUPPL497  
FEBRUARY 2000

# **AEROSPACE MEDICINE AND BIOLOGY**

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Records are arranged in categories 51 through 55, the Life Sciences division of *STAR*. Selecting a category will link you to the collection of records cited in this issue pertaining to that category.

<b>51</b>	<b>Life Sciences (General)</b>	<b>1</b>
<b>52</b>	<b>Aerospace Medicine</b> Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.	<b>10</b>
<b>53</b>	<b>Behavioral Sciences</b> Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	<b>19</b>
<b>54</b>	<b>Man/System Technology and Life Support</b> Includes human engineering; biotechnology; and space suits and protective clothing.	<b>24</b>
<b>55</b>	<b>Exobiology</b> Includes exobiology; planetary biology; and extraterrestrial life.	<b>31</b>

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Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.

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# Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA; Mar. 1996; 130p; In English  
Contract(s)/Grant(s): RTOP 505-68-70-04
- ❹ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❺ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❻ Author
- ❼ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

## Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
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9. Subject Terms

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# AEROSPACE MEDICINE AND BIOLOGY

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*A Continuing Bibliography (Suppl. 497)*

FEBRUARY 2000

51

## LIFE SCIENCES (GENERAL)

*Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.*

20000011803 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA

**The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report**

Still, Kenneth R., Editor, Naval Health Research Center, USA; Wilson, Cody L., Editor, Medical Service Corps, USA; October 1999; 96p; In English; See also 20000011804 through 20000011813

Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): CPIA-Publ-686-Special-Report; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

The science of toxicology has changed dramatically since the discipline was formally founded. The use of animal models in toxicity testing is still the method of choice for assessing the hazards associated with exposure to chemical compounds. A broad scope of approaches to toxicity testing provides data ranging from acute lethality to organ-specific toxicity (e.g., reproductive effects) to carcinogenicity. Although the use of animal models dominates many toxicology studies, many in vitro alternatives to animal use have been developed over the past two decades. A full gambit of toxicity tests, including both in vivo and in vitro assays, serve as the foundation for evaluation of chemicals. Safety evaluation and risk assessment processes draw on several basic science fields. Data from toxicity tests serves in combination with other information, such as exposure data and the biology sensitive populations, in the risk assessment process. Risk assessment weighs heavily in setting regulatory standards. The Layman's Guide to Toxicology summarizes the major concepts of this science as they relate to technical, non-science industrial professionals. The Guide is written by toxicologists and industrial hygienists and is aimed at conveying the important aspects of toxicology to other industrial professionals in an effort to bridge the gap between technical disciplines. The Guide was prepared under the auspices of the Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee - Safety & Environmental Protection Subcommittee, for use as a reference for the propulsion community.

Author

*Toxicity; Toxic Hazards; Hazardous Materials; Toxicology; Risk; Assessments; Safety*

20000011804 Naval Health Research Center, Toxicology Detachment, Wright-Patterson AFB, OH USA

**Toxicity Testing of Chemical Compounds**

Wilson, Cody L., Medical Service Corps., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 3-6; In English; See also 20000011803

Contract(s)/Grant(s): NEHC-1323; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

Toxicity testing of chemical compounds is a complex process aimed at defining the potential human and animal health hazards associated with exposure to a compound of interest. Health outcomes associated with a short-term exposure are often readily identifiable, whereas low-level exposures over a long period of time may result in more obscure effects. Adverse effects resulting from a short-term exposure are often referred to as 'acute' and those associated with long-term exposures as 'chronic.' Although laboratory animals have been utilized for many years as toxicity testing models, numerous in vitro techniques are now available which

not only reduce the number of animals required for experimentation, but also reduce cost and increase accuracy and reproducibility. This paper will focus on aspects of toxicity testing study design.

Author

*Chemical Composition; Toxicity; Human Beings; Animals*

20000011805 Naval Health Research Center, Toxicology Detachment, Wright-Patterson AFB, OH USA

#### **Definition of the Toxicity of Materials**

Jederberg, Warren W., Naval Health Research Center, USA; Still, Kenneth R., Naval Health Research Center, USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 7-11; In English; See also 20000011803

Contract(s)/Grant(s): NEHC-1323; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

Toxicology information available on Material Safety Data Sheets (MSDSs) is unfamiliar to most workers. Further, regulated or recommended exposure values for workers from the Occupational Safety and Health Administration [OSHA] and the American Conference of Industrial Hygienists (ACGIH) are difficult to interpret and apply without an understanding of how these values are derived. Discussions in past meetings have illustrated that the interpretation and application of toxicologic information available in the workplace present problems to workers and managers alike. The intent of this presentation is to familiarize the audience with the techniques used and the interpretation of data collected to determine the "toxicity" of materials. Much of the information given in common sources is taken from technical literature and not paraphrased for use by the majority of readers. An overview of the toxicity data contained in MSDSs and their interpretation in the moderately toxic, and nontoxic) will be discussed. The interpretation and implementation of exposure criteria from OSHA (PELs) and ACGIH (TLVs) in the workplace will be explained. Criteria for classification of materials as "Confirmed Human Carcinogen," "Suspected Human Carcinogen," "Animal Carcinogen." Not with the information provided, personnel tasked with interpreting the toxicologic data from common sources will be able to protect themselves, and the environment more effectively.

Author

*Toxicity; Toxicology; Toxic Hazards; Safety; Health*

20000011806 Naval Health Research Center, Toxicology Detachment, Wright-Patterson AFB, OH USA

#### **Basic Concepts in Industrial Hygiene as Applied in the Chemical Propulsion Industry**

Jederberg, Warren W., Naval Health Research Center, USA; Still, Kenneth R., Naval Health Research Center, USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 13-18; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

The intent of this paper is to provide sufficient information to allow the reader to recognize the need for Industrial Hygiene and describe some of the approaches used in evaluating and controlling occupational hazards in the Chemical Propulsion Industry. The information provided should also guide the reader in referring to the supporting Industrial Hygiene activity in a way that will maximize the support and provide a springboard for dialogue in solving "real world" problems encountered in the chemical propulsion industry.

Author

*Hygiene; Industrial Safety; Hazards; Health Physics*

20000011807 Army Medical Research Detachment, Wright-Patterson AFB, OH USA

#### **How Occupational Exposure Standards are Set**

Langford, R. E., Army Medical Research Detachment, USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 19-28; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

Occupational and environmental exposure standards are established by two different kinds of organizations: private consensus organizations and governmental regulatory authorities. The first uses knowledge of a particular industry or endeavor together with scientific studies and injury experience to set standards protective of the majority of workers. The second, usually the Federal government or state governments through quasi-judicial agencies, boards, and bureaus, often use the standards from consensus groups as a starting point, but then develop exposure standards which carry the force of law with civil and criminal penalties for exceeding the limits. The workers considered by these legal standards may include wider populations than those of consensus organizations such as older, pregnant, immune system compromised, etc. The military is in a different situation; the worker population is generally young, of good health, and highly dedicated so that military-unique exposure standards for chemi-

cals and scenarios not met in civilian industries sometimes need to be established. Some of the consensus organizations have had their standards, either in whole or in part, directly made into law by regulatory fiat, while other standards may differ from those set by regulatory agencies. Some of the more common occupational standard-setting organizations are the American Conference of Governmental Industrial Hygienists (ACGIH), the National Council on Radiological Protection and Measurements (NCRP), the American National Standards Institute (ANSI), and others. Regulatory agencies include the Occupational Safety and Health Administration (OSHA), the Environmental Protection Agency (EPA), the Nuclear Regulatory Commission (NRC), the Department of Transportation (DOT), and others. There can be overlapping areas of interest which have often led to standards being set by two or more different agencies; sometimes the regulatory standards of the different agencies agree; sometimes they don't. A brief history of occupational, and, to a lesser extent, environmental, exposure standards are presented with the current status of both consensus and regulatory standards. A few examples are presented where these two groups have set different levels of protection. The status of standards with respect to developing science is considered. Military-unique standards, and how they are set, is also addressed.

Author

*Personnel; Exposure; Health; Safety; Standards; Organizations; Populations*

20000011808 Naval Health Research Center, Toxicology Detachment, Wright-Patterson AFB, OH USA

**The Risk Assessment Paradigm: Fact and Utility**

Still, Kenneth R., Naval Health Research Center, USA; Jederberg, Warren W., Naval Health Research Center, USA; Alexander, William K., Naval Health Research Center, USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 29-36; In English; See also 20000011803

Contract(s)/Grant(s): NEHC-1323; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

In 1983 the National Research Council published the "Red Book" on risk assessment in the government. This protocol of risk assessment principles is used to this day. In 1994 the "Red Book" was updated to include basic risk assessment tenets and currently developed methodological techniques and was published as Science and Judgement in Risk Assessment. The elements of risk analysis and risk assessment will be presented in this paper and specific examples relating to chemical propulsion will be used. The elements of risk assessment include hazard identification, dose-response assessment, exposure assessment and hazard characterization. Examples from the chemical propulsion arena will be used to elucidate the theory behind risk assessment. Human health risk assessment explanation will include chemicals and processes, levels of contaminants, activity patterns and behavior, toxicity and exposure assessments, and risk characterization. These groupings of risk assessment will be linked with the theory and utility of risk evaluation, risk management, and risk communication to complete the loop for risk analysis.

Author

*Risk; Assessments; Hazards; Characterization*

20000011809 Naval Medical Research Inst., Toxicology Div., Wright-Patterson AFB, OH USA

**The Role of Toxicology in the Risk Assessment of Hazardous Materials**

Mattie, David R., Naval Medical Research Inst., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 37-41; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

The chemical risk assessment process and the need for health-based approaches to identify and characterize potential hazardous substances will be explained in this paper. The risk assessment process can be applied to both workplace and environmental settings. Toxicology will be defined and related to the risk assessment process. A brief overview of toxicity screens and tests will be presented in order to help make toxicity data more meaningful. Toxicity data for Halon 1301 replacements and trichloroethylene (TCE) will be presented as examples. The paper will conclude with a description of Tri-Service Toxicology; what it is and what this laboratory can provide to the Department of Defense (DoD), industry and academia.

Author

*Chemical Reactions; Risk; Assessments*

20000011810 Geo-Centers, Inc., Wright-Patterson AFB, OH USA

**Acute Lung Injury, The Acute Respiratory Distress Syndrome and Inhalation Injury**

Kimmel, Edgar C., Geo-Centers, Inc., USA; Still, Kenneth R., Naval Medical Research Inst., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 43-58; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

A brief overview of fundamental aspects of the continuum of diseases from Acute Lung Injury (ALI) to the more severe form Acute Respiratory Distress Syndrome (ARDS) is given. The review is not technologically comprehensive and is intended as an introductory primer for Naval operational personnel interested in health risks associated primarily with inhalation of smoke. Although there are numerous and varied causes of ARDS, the focus of this synopsis is on inhalation injury. In particular, the risk of ALI/ARDS from inhalation of combustion products from materials of military interest.

Author

*Injuries; Lungs; Respiration; Signs and Symptoms*

20000011811 Naval Medical Research Inst., Toxicology Detachment, Wright-Patterson AFB, OH USA

**Performance Degradation: Is It Important for the Assessment of Toxicants? An Example Using Jet Fuel**

Nordholm, A. F., Naval Medical Research Inst., USA; Ritchie, G. D., Naval Medical Research Inst., USA; Rossi, J., III, Naval Medical Research Inst., USA; Still, Kenneth R., Naval Medical Research Inst., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 59-68; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

The intent of this paper is to provide sufficient information to allow the reader to recognize the need for neurobehavioral analysis of possible deficits in human performance capacity associated with exposure to chemical toxicants, and to understand the role of neurobehavioral toxicity evaluation in the Military Deployment Toxicology Assessment Program. A recent study of the effects of repeated exposure of rats to jet fuel vapor is summarized to demonstrate the use of laboratory animals to model possible human neurobehavioral performance degradation in operational military deployment scenarios.

Author

*Human Performance; Toxicity; Toxicology; Human Behavior; Neuropsychiatry; Neurology*

20000011812 Naval Medical Research Inst., Toxicology Detachment, Wright-Patterson AFB, OH USA

**Introduction to Dermatotoxicology**

Jederberg, Warren W., Naval Medical Research Inst., USA; Still, Kenneth R., Naval Medical Research Inst., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 69-75; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

In the industrial environment the two major routes of exposure to chemicals are through the respiratory tract and the skin. Occupational skin problems have potential impact on the health and welfare, of millions of workers and are one of the leading causes of lost days as a result of work-related illnesses. According to the Bureau of Labor Statistics, dermatological conditions other than injuries were responsible for 14% of all occupational disease case reports in 1992. There are a number of possible agents that can injure the skin: chemical, mechanical, physical, biological and botanical. It will be demonstrated that concurrent exposure to chemicals and other agents can significantly modify the potential for damage to the skin. Chemical propulsion industry workers are exposed to a variety of accelerants, bulking materials, explosives, composites, and exotic compounds. Some of these chemicals are used in the manufacturing of propulsion vehicles and some are the by-products of vehicle activities. The purpose of this document is to familiarize the reader with the principles governing the toxicity of chemicals to which the skin might be exposed in the chemical propulsion industry.

Derived from text

*Toxicity; Toxic Hazards; Toxicology; Exposure*

20000011813 Naval Medical Research Inst., Toxicology Detachment, Wright-Patterson AFB, OH USA

**Concepts in Toxicology: Cardiac Sensitization**

Smith, E. A., Naval Medical Research Inst., USA; Still, Kenneth R., Naval Medical Research Inst., USA; The Layman's Guide to Toxicology: JANNAF Safety and Environmental Protection Subcommittee Special Report; October 1999, pp. 77-83; In English; See also 20000011803; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC, Hardcopy

With the discovery that chlorofluorocarbons (CFCs) and halocarbons (Halons) deplete atmospheric ozone, several international agreements were drafted, starting in 1987 with the Montreal Protocol. The agreements mandated the replacement of these chemicals with more 'environmentally friendly' agents. CFCs and Halons are used primarily as refrigerants and fire suppressants. This has presented the Navy with the challenge of replacing these agents by or before the set international deadlines, while at the same time fulfilling it's national security obligations in maintain fleet readiness. The Navy has in its fleet of ships one of the world's largest installed bases of CFC-12 air conditioning and refrigeration systems. Therefore, the search for an appropriate replacement agent is no small undertaking. Not only does the new agent have to meet specific engineering requirements; reducing the need

for extensive modification to pre-existing equipment, but it must also meet certain toxicological standards; in order to comply with existing safety regulations. One of the many components in evaluating the toxicity of these replacement agents is cardiac sensitization. Cardiac Sensitization is defined as the hypersensitization of the heart to adrenaline (epinephrine) when an individual is exposed to an exogenous chemical. Hypersensitization is characterized by the development of arrhythmia and typically occurs during stressful or strenuous situations (i.e., fire or physical excursion). A chemical's potential to produce cardiac sensitization is evaluated using the beagle dog model. The model operates by exposing the dog to increasing concentrations of the chemical until the onset of arrhythmia. When the animal model was developed, the observation of life-threatening arrhythmia was the only known and acceptable endpoint (parameter) by which to measure cardiac sensitivity. However, recent advances in the various sciences and the view of the general public have rendered the model rather extreme and the endpoint (arrhythmia) controversial. The development of an in vitro (non-whole animal) test would be useful, both from a practical as well as a humane point of view. Even though several in vitro models have been attempted, it is still apparent that a better understanding of the mechanism that produces cardiac sensitization is needed. Developing an in vitro cardiac sensitization test would provide the Department of Defense with a means to quantitatively evaluate chemicals for cardiac effects. Therefore, the aim of this research is to isolate the physiological threshold response that drives the heart toward arrhythmia. This response may be a mechanical, biochemical or electrophysiological process. Mechanical, biochemical, and electrophysiological parameters will be evaluated prior to the development of near-fatal arrhythmia. The anticipated result is the identification of a parameter or series of parameters that will accurately predict potential cardiac sensitizers (chemicals) before life-threatening electrophysiological and hemodynamic changes occur.

Derived from text

*Toxicity; Cardiology; Heart; Biochemistry*

20000012158 Centre National de la Recherche Scientifique, Lab. De Physique de La Matiere, Villeurbanne, France

Workshop: Applications of SQUID Magnetometry

Jun. 17, 1999; 209p; In English, 16-17 Jun. 1999, Lyon, France

Contract(s)/Grant(s): F61775-99-WF058

Report No.(s): AD-A370394; EOARD-CSP-99-5058; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The Final Proceedings for Applications of SQUID Magnetometry, 16 June 1999 - 17 June 1999. This is an interdisciplinary conference. Topics include: non-destructive evaluation, geophysics, biomolecular dynamics; and biomedical applications in neurology and cardiology.

DTIC

*Conferences; Magnetic Measurement*

20000012441 Department of Health and Human Services, National Toxicology Program, Research Triangle Park, NC USA  
NTP Technical Report on the Toxicity and Metabolism Studies of Chloral Hydrate (CAS No. 302-17-0) Administered by Gavage to F344/N Rats and B6C3F1 Mice

Beland, Frederick A., National Center for Toxicological Research, USA; 1999; 142p; In English

Report No.(s): PB2000-101393; NTP-TOXICITY-SER-59; NIH/PUB-99-3944; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Chloral hydrate is widely used as a sedative and a hypnotic in pediatric medicine. It is also a byproduct of water chlorination. Chloral hydrate has been shown to be genotoxic in numerous prokaryotic and eukaryotic assay systems including human lymphocytes in vitro. One of its metabolites, trichloroacetic acid, has demonstrated hepatocarcinogenic activity in mice. Trichloroethylene and perchloroethylene, both of which are metabolized to chloral hydrate, have been shown to be carcinogenic in rats and/or mice. Because of this evidence of carcinogenicity and because of the wide-spread use of chloral hydrate, 16- or 17-day range-finding toxicity studies and separate 16- or 17-day metabolism studies were performed in F344/N rats and B6C3F1 mice in preparation for further long-term rodent studies. In addition, in vitro studies of the metabolism and DNA-binding capacity of chloral hydrate and its metabolites were performed. Genetic toxicity studies were conducted in *Salmonella typhimurium*, cultured Chinese hamster ovary cells, *Drosophila melanogaster*, and mouse bone marrow cells.

NTIS

*Toxicity; Metabolism; Bone Marrow; Cells (Biology); Chlorination; Deoxyribonucleic Acid; Drosophila; Trichloroethylene*

20000012488 Texas Univ. Health Science Center, Dept. of Otolaryngology, San Antonio, TX USA

Development of the Statocyst in the Freshwater Snail *Biomphalaria Glabrata* (Pulmonata, Basommatophora)

Gao, Wenyuan, Texas Univ. Health Science Center, USA; Wiederhold, Michael, Texas Univ. Health Science Center, USA; Hejl, Robert, Texas Univ. Health Science Center, USA; Hearing Research; 1997; ISSN 0378-5955; Volume 109, pp. 125-134; In English

Contract(s)/Grant(s): NAG2-952; NSF IBN-95-29136; Copyright; Avail: Issuing Activity, Hardcopy

The development of the statocyst of the freshwater snail *Biomphalaria glabrata* has been examined from embryo to adult. Special emphasis was put on the growth of the statoconia in the statocysts. In the statocysts of embryonic snails (90-120 h after oviposition) there is not a single statolith but an average of 40-50 statoconia per statocyst. The number of statoconia increases to 385-400 when the snails reach a shell diameter of 4 mm and remains relatively constant thereafter, irrespective of shell size. Small statoconia are found in supporting cells, which suggests that the statoconia are produced within these cells. The average diameter of statoconia and the total mass of statoconia increase with increasing shell diameter. The average number of large statoconia (diameter greater than 7 micrometers) per statocyst continues to increase from 2 to 10 mm animals while the number of small ones (diameter less than 4 micrometers) initially rises and then decreases after 4 mm. These results demonstrate continuous growth of the statoconia in the cyst lumen of *Biomphalaria*. The single statoconia vibrate in a regular pattern in vivo, indicating beating of the statocyst cilia. The statoconia sink under the influence of gravity to load and stimulate receptor cells which are at the bottom. The length of cilia and the size of statocyst gradually increase as the animal grows. However, the increase in the volume of the statocyst is relatively small compared with the increase in body weight during normal development.

Author

*Snails; Embryos; Body Weight; Cells (Biology); Fresh Water; Tissues (Biology); Development*

20000012706 Texas Univ., Dept. of Geosciences, Austin, TX USA

**Nannobacteria on Earth are Truly Living Organisms**

Folk, R. L., Texas Univ., USA; Lynch, F. L., Mississippi State Univ., USA; Workshop on Mars 2001: Integrated Science in Preparation for Sample Return and Human Exploration; 1999, pp. 34; In English; See also 20000012695; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The crux of the argument about so-called Martian "nannobacteria" discovered by NASA in meteorite ALH84001, is that they are "too small to be bacteria". When in 1990 mineralized nannobacteria were first discovered in hot spring travertines of Viterbo, Italy, their size was typically 50 - 200 nm. This is about 1/10 the diameter, or 1/1000 the volume of most bacteria; nannobacteria are larger than most viruses (typically 10-30nm). The Martian features were balls, worms and filaments around 50nm in diameter, exactly in the size range of the earthly analogues. Biologists' arguments against the concept of nannobacteria were good in theory; a cell smaller than 200 nm in diameter should not have sufficient room inside to contain genetic coding, ribosomes and other organelles required for metabolism and "life"-life as we "know" it in the 1990's. However, new facts are continually bursting old dogmatic wineskins, and such has been the case in the last few years. The lower limit of "life" has descended to at least 50 nm or perhaps even smaller. Now, in 1999, the Martian nannobacteria are clearly within the range of known culturable organisms on earth, no matter whether one wants to call them nannobacteria, viruses, nannobionts or anything in between and no matter where one wishes to place the fuzzy lower boundary of "life". Before Leeuwenhoek or Pasteur, no one thought that anything invisible to the naked eye could be "alive". But the optical microscope lowered this limit to 0.2 microns and later the scanning electron microscope's higher resolution revealed a whole hidden nano-universe awaiting investigation. The poster will show examples of nano-organisms in the 50-150 nm size range from various laboratories. Most of these are culturable, some stain positively for DNA, some are composed of C, N, O (the elements in living tissue) and some even show cell walls. Foremost among the laboratories working on nanoorganisms is a group of medical researchers at the University of Kuopio, Finland under Olavi Kajander. They found "nanobacteria" in mammal blood in the early 1990's, but nobody believed them and they could not get their findings published; "...too small to be bacteria....", said the rejection notices. Finally in 1993 they published in *Scanning*, an SEM journal where they could evade bio-critics. Their work was little noticed until 1996: after the NASA announcement about Martian life, an Austin-American Statesman reporter, Dick Stanley, looked up the word "nan(n)obacteria" in his search engine and found two laboratories independently working on the same creatures, the University of Texas and the Kajander Group. So the Finnish work finally swam into the ken of geologists and astronomers. Professor Allen Hamilton, microbiologist at the University of Aberdeen, Scotland, has successfully cultured nannobacteria on samples of feldspar, using lactate and temperatures up to 90C. His samples of 100 x 300 nm "worms" look exactly like the SEM of Martian "swimming hordes", and his other cultured colonies are made of 100 nm balls. These nannobacteria are not associated with larger bacterial cells (ie. they are not infecting anything) so they must be able to reproduce and metabolize independently, unlike viruses.

Author

*Bacteria; Organisms; Bacteriology; Exobiology; Extraterrestrial Life*

20000013175 Kyoto Univ., Dept. of Physics, Japan

**Toward the Creation of an Artificial Cellular System**

Yoshikawa, Kenichi, Kyoto Univ., Japan; Nomura, Shin-Ichirou, Kyoto Univ., Japan; Structure Formation and Function of Gaseous, Biological and Strongly Coupled Plasmas; Sep. 1999, pp. 1-4; In English; See also 20000013174; No Copyright; Avail:

CASI; A01, Hardcopy; A02, Microfiche

With the development of molecular biology and biochemistry, knowledge of the details of biological molecules has been increasing rapidly. On the other hand, the phenomenon of life itself remains a mysterious matter. Individual biological cells of several and several tens of micrometers maintain life by themselves in a self-organized manner. It is obvious that the essence of life cannot be understood as the simple accumulation of the knowledge of individual biological molecules. We are currently studying life phenomena, based on the view that living or exist with self-organized supramolecular assemblies under nonequilibrium thermodynamically open conditions. Over a number of years, we have focused our efforts on the development of the physical chemistry of the folding transition of giant macromolecules, with special emphasis on giant DNA molecules.

Derived from text

*Molecular Biology; Biochemistry; Cells (Biology)*

20000013177 Nagoya Univ., Graduate School of Human Informatics, Nagoya, Japan

**Stepwise Collapse of Polyelectrolyte Chains Entrapped in a Finite Space**

Takagi, Seiji, Nagoya Univ., Japan; Yoshikawa, Kenichi, Kyoto Univ., Japan; Structure Formation and Function of Gaseous, Biological and Strongly Coupled Plasmas; Sep. 1999, pp. 20-25; In English; See also 20000013174; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

We performed a theoretical study on the nature of the collapsing, or folding, transition of polyelectrolyte chains entrapped in a narrow closed space, as a model of living cells enclosing giant DNA chains. We adopted a theoretical treatment with a mean-field approximation by taking into account the effect of the translational entropy of small ions. For a system with two, long and short, chains trapped in a narrow space, we found that, with an increase in the concentration of an added trivalent cation,  $P^{+}$ , the short chain collapses first while the long chain remains an elongated coil. With increased  $P^{+}$ , the long chain collapses while the short chain decollapses. Finally, with an excess of  $P^{+}$ , both the short and long chains collapse. For a system with stiff and flexible chains, with increased  $P^{+}$ , the flexible chain collapses while the stiff chain remains an elongated coil. With increased  $P^{+}$ , both the stiff and flexible chains collapse. The state with collapsed stiff chain and elongated flexible chain is metastable state for the whole concentration region of trivalent cation. It may be worth examining such theoretical expectations by actual experiments.

Author

*Collapse; Folding; Electrolytes; Chains*

20000013178 Institute for Fundamental Chemistry, Kyoto, Japan

**Thermodynamics of Folding Phase-Transition of Single T4DNA Molecules in Poly(Ethylene Glycol) Solution**

Mayama, H., Institute for Fundamental Chemistry, Japan; Yoshikawa, K., Kyoto Univ., Japan; Structure Formation and Function of Gaseous, Biological and Strongly Coupled Plasmas; Sep. 1999, pp. 26-32; In English; See also 20000013174; Prepared in cooperation with Yoshikawa Lab.; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Recently, it has been established that single DNA molecule exhibits discrete transition between the elongated coil state and the compact folded state, and that there considerable width on the concentration of condensing agents such as poly(ethylene glycol) and polycations. In this work, we studied the effect of temperature on the bimodal distribution of conformation for the ensemble of T4DNA chains (166kbp) at a fixed concentration of poly(ethylene glycol) using single-chain observation with fluorescence microscopy. From the van't Hoff-type relationship, the entropy change in the transition is  $\Delta S = +11.3 \text{ kJ/mole}$ , and the change in the heat content is  $\Delta H = +4.77 \times 10^4 \text{ (exp } -20) \text{ J/mole}$  at  $T_c = 306 \text{ K}$ , where  $k$  is the Boltzmann's constant. The positive value of  $\Delta S$  with the unfolding transition is discussed in relation to the increase in the translational entropy of counterions.

Author

*Thermodynamics; Folding; Phase Transformations; Bacteriophages; Deoxyribonucleic Acid; Molecules; Polyethylenes; Glycols; Critical Temperature*

20000013286 Academia Sinica, Inst. of Biophysics, Beijing, China

**Effects of Clinorotation on Cytosolic Free Calcium Level in Embryonic Chick Brain Cells**

Shen, Hong-Lue, Academia Sinica, China; Chen, Ya, Academia Sinica, China; Sun, Tong, Academia Sinica, China; Zhang, Jin-Zhu, Academia Sinica, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 447-450; In Chinese

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

Cytosolic free  $\text{Ca}^{+2}$  ( $[\text{Ca}^{+2}]_{\text{sub } i}$ ) in suspended brain cells of chicken embryos hatched for 6-18 d (E6-E18) was measured by using the fura-2/AM fluorescence spectroscopy. The biological effects of microgravity on the embryonic chicks were simulated by revolving on a clinostat during their hatch. The experimental results showed that level of  $[\text{Ca}^{+2}]_{\text{sub } i}$  in E8-E17

embryonic brain cells decreased after revolving for different period.  $[Ca^{+2}]_{(sub\ i)}$  in brain cells of E10 and E13 chick embryos reduced significantly ( $P$  is less than 0.01) after revolving 4-7 h and 24 h respectively. When E10 and E13 chick embryos were incubated again as long as being revolved,  $[Ca^{+2}]_{(sub\ i)}$  in brain cells rose but were still lower than the controls. The levels of cytosolic free calcium in brain cells of revolved E17 embryonic chicks increased after being colorpunctured by red light. These results demonstrate that the decrease of  $[Ca^{+2}]_{(sub\ i)}$  in embryonic chick brain cells caused by clinorotation is reversible, and colorpuncture can accelerate this recovery.

Author

*Biological Effects; Brain; Cells (Biology); Embryos*

20000013289 Academia Sinica, State Key Lab. of Microbial Resources, Beijing, China

**Biological Responses of a Streptomyces Strain Producing-Nikkomycin to Space Flight**

Luo, Ai-Qun, Academia Sinica, China; Gao, Chun-Xiao, Academia Sinica, China; Song, You-Xin, Academia Sinica, China; Tan, Hua-Rong, Academia Sinica, China; Liu, Zhi-Heng, Academia Sinica, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 411-414; In Chinese

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

In order to see biological responses to the production of Nikkomycins in general and Nikkomycin X and Z in particular by space conditions, *Streptomyces ansochromogenus*, a Nikkomycins-producing strain, was carried onboard a satellite for 15 d in 1996. Several strains were isolated from the treated sample and found that the productivity of Nikkomycins in all was increased by 13-18 percent, and the proportion of Nikkomycin X and Z increased correspondingly. Besides, some biological properties of the isolated strains varied markedly.

Author

*Biological Effects; Streptomycin; Exobiology; Space Flight*

20000013290 City Univ. of Hong Kong, Dept. of Biology and Chemistry, Kowloon, Hong Kong

**Effect of Space Flight on Hereditary Characteristics of Anabaena Oryza (Cyanobacteria)**

Hu, Zhang-Li, City Univ. of Hong Kong, Hong Kong; Song, Lirong, City Univ. of Hong Kong, Hong Kong; Liu, Yong-Ding, City Univ. of Hong Kong, Hong Kong; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 406-410; In Chinese

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

A retrieved monoclonal strain AoSR16 with high nitrogenase activity was reflowed in space onboard a satellite, and characteristics differentiation was found again when the sample was retrieved and isolated in the laboratory. Some isolates still kept their nitrogenase activity on the same level of original strain, while other isolates like AoSR16-17 expressed higher nitrogenase activity. After 2 years of maintaining culture, the activity of nitrogenase in AoSR16-17 remained continuously high. Comparative studies between AoSR16-17 and the original strain were carried out in regard of genetic features. The polymorphism of total genomic DNA in AoSR16-17 and the original strain was studied by RAPD analysis, using 120 10-mer random primers. Of approximately 500 amplified electrophoresis bands, 4 polymorphic fragments were discernible between AoSR16-17 and the original one, the polymorphism was thus calculated to be around 0.08%. These four bands had been purified and further work is under way.

Author

*Space Flight; Heredity; Flight Characteristics; Anabaena; Aerospace Environments; Bacteria*

20000013292 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

**Effects of Acute Moderate Hypoxia on Human Performance of Arithmetic**

Wu, Xing-Yu, Fourth Military Medical Univ., China; Li, Xue-Yi, Fourth Military Medical Univ., China; Han, Li-Ping, Fourth Military Medical Univ., China; Wang, Tao, Fourth Military Medical Univ., China; Wei, Ying-Bo, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 391-395; In English

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

To observe the effects of acute moderate hypoxia on human performance of arithmetic, the continuous calculation test, addition - subtraction test and mental arithmetic tests were made in 16 health young male subjects during exposure to altitude of 300 m (control), 3600 m, 4400 m and 5000 m by mean of hypobaric cabin simulation. Error rate of the continuous calculation test and reaction time of addition - subtraction test increased significantly and performance decreased significantly ( $P$  is less than 0.05) after exposure to 3600 m for 1 h. Reaction time, total number and performance of all tests decreased significantly ( $P$  is less than 0.05) during exposure to 4400 m. Performance of all tests decreased ( $P$  is less than 0.01) after exposure to 5000 m for 30 min.

Author

*Human Performance; Hypoxia; Arithmetic; Human Factors Engineering*

20000013351 Institute of Space Medico-Engineering, Beijing, China

**Identification of Brain Injury After Impact to Monkeys Head**

Wu, Gui-Rong, Institute of Space Medico-Engineering, China; Zhang, Yun-Ran, Institute of Space Medico-Engineering, China; Wang, Yu-Qing, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; Xiang, Qiu-Lu, Institute of Space Medico-Engineering, China; Han, Yan-Fang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 425-429; In Chinese Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the study of head impact injuries, to find a clear demarcation line between brain functional disorder and brain contusion is very difficult. In order to observe changes of medical parameters in monkeys after head impact, 24 monkeys underwent head impact of various intensities (1.9 - 3.0 kN) by means of a dynamic loader while 4 monkeys served as control. According to the clinical diagnostic standard, 8 monkeys were classified as simple concussion of the brain, 6 monkeys as brain contusion with organic damage of the brain and 3 of the 6 monkeys were also accompanied with signs of concussion of the brain. The results indicated that monkeys with signs of brain concussion revealed temporary disappearance of physiological reflexes, slowing of respiration and heart rate and decrease of Nissl bodies in brain stem cells. RBC and CK - BB were found in cerebrospinal fluid in monkeys with organic damage of the brain, while in those with simple cerebral concussion as well as the controls, no RBC or CK - BB was found. It demonstrated that the appearance of CK - BB or RBC in the cerebral spinal fluid can be regarded as a demarcation line between functional disorder and organic damage of the brain. This may be useful for assessing the degree of brain concussion in experimental animals.

Author

*Brain; Head (Anatomy); Impact Damage; Aerospace Medicine*

20000013565 California Univ., Section of Neurobiology, Physiology and Behavior, Davis, CA USA

**The Effect of Age in the Alteration in Fluid Balance of Rats in Response to Centrifugation *Final Report***

Fuller, Charles A., California Univ., USA; [2000]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With an increase in gravity load induced by centrifugation or upon return to Earth following spaceflight, there is a period of adjustment in fluid balance in rats. With centrifugation there is a reduced fluid intake with maintenance of the rate of urine excretion. Following spaceflight there is an increase in urine output and maintenance of fluid intake. The initial period of acclimation to hypergravity is associated with a net loss of fluids. In the present study in response to centrifugation at 2.0 G this period of acclimation is present in mature rats for a longer period of time, about 24 hours. Following this initial response a period of over compensation has previously been reported. In the present study this was not observed. The net effect of these alterations in water intake and output in response to centrifugation for 14 days was slight increase in the percent total body water, with effective compensation seen in both young and mature rats. Older rats have been shown to have a reduced relative thirst and compensatory renal function in response to hypohydration, hyperosmolality and pharmacological stimuli. Responsiveness to these stimuli are delayed and/or attenuated in older animals. Similar findings were noted in the present study in the initial response to centrifugation. The older animal had a delayed return of fluid intake to control levels. The delay of one day did not appear to effect long-term fluid homeostasis, as there was difference in the response of percent total body water at the end of 14 days of centrifugation with both age groups having a slight but significant increase. This increase has been attributed to the increase in lean body mass induced by centrifugation.

Derived from text

*Age Factor; Body Fluids; Aerospace Medicine; Rats; Renal Function; Gravitation; Centrifuging*

20000014092 Boston Univ., Center for Advanced Biotechnology, Boston, MA USA

**Genetically Engineered Microorganisms Containing Streptavidin for Environmental Monitoring *Final Report, 26 Sep. 1994 - 31 Dec. 1997***

Cantor, Charles R.; Dec. 01, 1999; 7p; In English

Contract(s)/Grant(s): DAAH04-94-2-004

Report No.(s): AD-A371484; ARO-33950.3-LS; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This project had three specific aims. The first was the design, creation, and testing of genetically engineered microorganisms that degrade specific hazardous compounds and then self-destruct under natural environmental conditions. The second was to design and characterize novel self-assembly systems to generate small structural biomaterials for biological and materials science applications. The third was to develop sensitive monitoring systems for microorganisms usable in the field. In the first project, we successfully created a streptavidin-based suicide system. We also designed a supplementary, potentially very powerful suicide system and constructed part of it. In the second project, anti-parallel coiled-coil sequences have successfully been fused to the

C-terminus of streptavidin. In the third project, green fluorescent protein (GFP) has been fused to streptavidin, and the resulting fusion has shown potential promise for the GFP moiety to become a sensitive monitoring tag usable in the field.

DTIC

*Microorganisms; Genetic Engineering*

20000014095 Washington Univ., School of Oceanography, Seattle, WA USA

*Vibrational Sensing in Benthic Invertebrates Final Report, 10 Jan. 1993-31 Dec. 1998*

Jumars, Peter A.; Oct. 12, 1999; 3p; In English

Contract(s)/Grant(s): N00014-94-1-0656

Report No.(s): AD-A371490; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant funded completion of a number of studies on the effects of fluid motion on small planktonic organisms. It documented the response of some benthic marine invertebrates to prolonged vibrational stimuli at 50-200 Hz, perhaps indicative of energetic, bottom boundary-layer turbulence. It showed that vibrational artifact and flow intensity generally covary in laboratory flumes used for behavioral studies of animals. Most importantly, data analyzed under this grant gave early indication that high-frequency (> 40 kHz) low-angle acoustic backscatter could give information on activities of benthic macrofauna at unprecedented spatial and temporal scales.

DTIC

*Acoustic Scattering; Invertebrates; Microorganisms; Zooplankton; Backscattering; Plankton*

20000018023 California Univ., Section of Neurobiology, Physiology, and Behavior, Davis, CA USA

*Development of the Circadian Timing System in Rat Pups Exposed to Microgravity during Gestation*

Fuller, Charles A., California Univ., USA; [2000]; 43p; In English

Contract(s)/Grant(s): NCC2-886; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ten pregnant Sprague Dawley rat dams were exposed to spaceflight aboard the Space Shuttle (STS-70) for gestational days 11-20 (G 11-20; FILT group). Control dams were maintained in either a flight-like (FIDS group) or vivarium cage environment (VIV group) on earth. All dams had ad lib access to food and water and were exposed to a light-dark cycle consisting of 12 hours of light (- 30 lux) followed by 12 hours of darkness. The dams were closely monitored from G 22 until parturition. All pups were cross-fostered at birth; each foster dam had a litter of 10 pups. Pups remained with their foster dam until post-natal day 21 (PN 21). Pup body mass was measured twice weekly. At PN14 FILT pups had a smaller body mass than did the VIV pups (p is less than 0.01). Circadian rhythms of body temperature and activity of pups from two FILT dams (n = 8), two FIDS dams (n = 9) and two VIV dams (n = 7) were studied starting from age PN 21. All pups had circadian rhythms of temperature and activity at this age. There were no significant differences in rhythms between groups that could be attributed to microgravity exposure. We also examined the development of neural structures involved in circadian rhythmicity: the retina, the intergeniculate leaflet (IGL) and the circadian pacemaker, the suprachiasmatic nucleus (SCN). There were small differences between the flight and control groups at very early stages of development (G 20 and PN3) which indicated that the development of both the SCN and the IGL. These results indicate that exposure to the microgravity environment of spaceflight during this embryonic development period does not affect the development of the circadian rhythms of body temperature and activity, but may affect the early development of the neural structures involved in circadian timing.

Derived from text

*Circadian Rhythms; Microgravity; Rats; Fetuses; Embryology; Activity Cycles (Biology); Embryos; Pregnancy*

## 52

### AEROSPACE MEDICINE

*Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.*

20000011735 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France

*Current Aeromedical Issues in Rotary Wing Operations Problemes Actuels de Medecine Aeronautique Poses par les Operations Utilisant des Voilures Tournantes*

Current Aeromedical Issues in Rotary Wing Operations; August 1999; 356p; In English, 19-21 Oct. 1998, San Diego, CA, USA; See also 20000011736 through 20000011776; Original contains color illustrations

Report No.(s): RTO-MP-19; AC/323(HFM)TP/4; ISBN 92-837-0008-2; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

These proceedings include the Technical Evaluation Report, Keynote Address, and 41 papers from the Symposium sponsored by the NATO/RTO Human Factors and Medicine Panel, which was held in San Diego, California, USA from 19-21 October 1998. Rotary wing operations include military or civilian missions such as transport, medevac, and combat. A range of human factors problems may be implicated in helicopter mishaps, such as spatial disorientation or excessive workload. Furthermore, flying a helicopter can contribute to various specific pathologies, ranging from lower back pain to flight phobias. In several helicopter accidents, it has been suggested that injuries could have been avoided if adequate safety and protection technologies had been used. Although helicopters can be used for medevac involving large numbers of wounded, the use of helicopters has to be fully integrated with other transport systems and their equipment should be adapted for this type of mission. New training methods, such as crew resource management or spatial disorientation training, and new technologies, such as the "tactile situation awareness system" (TSASI) may, when fully implemented, help to avoid accidents. Utilization of swimming pools with specific tools for helicopter evacuation training can greatly reduce the risk of death by immersion. On the other hand, more effort is needed to improve the personal flight equipment. Although epidemiological data suggest that the risk of accidents and injuries is already low in certain air forces, the introduction of new protection technologies may help to further reduce the numbers of wounded. This symposium provided a review, of the state-of-the-art concerning the various human factors implicated in helicopter operations, new methods and systems for increasing safety and efficiency of the helicopter operations, and new methods and systems for increasing safety and efficiency of the helicopter crew.

Author

*Aerospace Medicine; Human Factors Engineering; Rotary Wing Aircraft; North Atlantic Treaty Organization (NATO); Resources Management; Conferences; Psychological Effects*

20000011753 Centro de Instruccion de Medicina Aeroespacial, Madrid, Spain

#### **Low Back Pain in Helicopter Pilots**

Vallejo, P., Centro de Instruccion de Medicina Aeroespacial, Spain; Lopez, J., Centro de Instruccion de Medicina Aeroespacial, Spain; Rios-Tejada, F., Centro de Instruccion de Medicina Aeroespacial, Spain; Azofra, J., Centro de Instruccion de Medicina Aeroespacial, Spain; DelValle, J., Centro de Instruccion de Medicina Aeroespacial, Spain; Velasco, C., Centro de Instruccion de Medicina Aeroespacial, Spain; Garcia-Mora, L., Fuerzas Aerom?viles del Ej?rcito de Tierra, Spain; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 20-1 - 20-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Back pain is a widespread problem among industrialized countries. Incidence of back pain is between 60 and 80%. Prevalence rate does not exceed 35% of the general population. It was determined that back pain is twice more frequent in helicopter pilots than in the general population. Many papers reported prevalence rates in excess of 50%, many reported prevalence exceeding 75%, and pain in the lumbar area is the most common experienced by the pilots. Most of these studies have been made through questionnaires purely subjective in regards of data collection, performed in the aircrews immediately after flight. One of the papers, performed in the Fuerzas Aeromoviles del Ejercito de Tierra (F.A.M.E.T.) showed figures up to 78% of pain related to helicopter flying activities and 60% of the total number referred to lumbar area. Among military helicopters aircrew world-wide, backache is perceived as so common that the majority of sufferers accept it as an occupational nuisance and rarely seek medical advise by the flight surgeon. An interesting work to prove that poor posture in flight is an important factor in etiology of low back pain was made. Studies of 18 pilots in the AH-1S helicopter flying alternately in the gunner's seat were made, where they maintain a vertical sitting and in the pilot's seat, where they lean forward and to the left in order to operate the controls. The intensity of the back pain was great and the onset was quicker in the pilot's seat than in the gunner's position. The constantly maintained asymmetrical position does not permit relaxation of the spinal musculature, this situation probably leads to spasm of paraspinous musculature, which become fatigued, and the resultant is a straightening of the normal lumbar lordosis. The purpose of this study will be to compare the right and left side lumbar muscular activity in helicopter pilots under real flight conditions in order to objectively prove the effects of asymmetrical posture on the musculoskeletal system by using surface electromyography and to correlate lumbar muscular activity with environmental and other variables such as type of flight, type of helicopter, flight time, age, physical fitness and height.

Derived from text

*Back Injuries; Pain; Musculoskeletal System; Aircraft Pilots; Electromyography; Computer Programs*

20000011754 COMALAT, Villacoublay-Air, France

**ALAT Helicopter Pilot Rachialges: Results of an Enquiry Concerning 560 Answers** *Les Rachialgies du Pilote d'Helicoptere de l'Alat: Resultats d'une Enquete a Propos de 560 Reponses*

Seynaeve, A., COMALAT, France; Burlaton, J. P., Hopital d'Instruction des Armees, France; Dolet-Ferraton, D., Centre Principal d'Expertises Medicales du Personnel Navigant de l'Aeronautique, France; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 21-1 - 21-11; In French; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The analysis about these results compared with the previous ones (1976) allows to point out that rachialgies of helicopter pilots are prevailing and are increasing from 49,15% to 66% (+17%). This increase implies both isolated cervicalgies (+7,20%) and locations at two levels: the back and the neck. But isolated lombalgies are decreasing (-16,5%). The increase of cervicalgies could be explained by the importance of the night flight; 40% of flight hours are out when equipped with night vision goggles, the weight of which (980 g) is added to the helmet's one. In other respects, the technological improvement of the helicopters fleet, thanks to the reducing of vibrations (generalization of plastic blades among others) has given reducing of lombalgies.

Author

*Aircraft Pilots; Spinal Cord; Back Injuries; Aerospace Medicine; Neck (Anatomy); Night Flights (Aircraft)*

20000011757 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Utilization of Medical Support Equipment on Board Army Rotary-Wing Aircraft**

Licina, Joseph R., Army Aeromedical Research Lab., USA; Hall, Bruce D., Universal Energy Systems, Inc., USA; Murphree, K. Blake, Universal Energy Systems, Inc., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 24-1 - 24-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The U.S. Army Airworthiness Certification and Evaluation (ACE) program at the U.S. Army Aeromedical Research Laboratory (USAARL) is designed to evaluate medical life support equipment for compatibility within the rotary-wing aviation or medical evacuation (MEDEVAC) environment. The program goes beyond any prior validation of medical equipment for use within the controlled hospital environment, and assesses the equipment in the context of the military environment, from the supply and distribution chain, through storage and use in field conditions. The end product is an assessment that assures the safety of the aircraft and its subsystems, the aircraft crew, the device itself, and ultimately, the patient. Since the program's inception in 1983, standards have evolved to better reflect the actual rotary-wing operational environment. This evolution challenges manufacturers striving to produce viable products to meet both hospital and in-flight requirements in the military and civilian sectors. From July 1992 to August 1998, 24 medical devices including monitor/defibrillators, infusion pumps, vital-signs monitors, and ventilators were tested under specified conditions of temperature, humidity, altitude and vibration (MIL-STD-810D and 810E). Electromagnetic emissions and susceptibility were measured (MIL-STD-461C, 461D), and human factors (MIL-STD-1472D) were evaluated. The devices were flight tested in the USAARL JUH-60A MEDEVAC helicopter. Thirty-two percent of the medical devices failed at least one environmental test. Ninety-one percent of the devices failed to meet the 461C and 461D standards. Only three devices were tested at the new 200 V/m radiated susceptibility level, but all failed. Failures included excessive conducted and radiated emissions and susceptibility to radiated emissions.

Author

*Aerospace Medicine; Medical Equipment; Armed Forces (USA); Human Factors Engineering; UH-60A Helicopter; Environmental Tests; Medical Services*

20000011767 Royal Air Force, Personnel and Training Command Headquarters, Gloucester, UK

**Moulded Lumbar Supports for Aircrew Backache: Comparison of Effectiveness in Fixed and Rotary Wing Aircrew**

Graham-Cumming, A. N., Royal Air Force, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 35-1 - 35-11; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This study was intended to compare the effectiveness of the individually moulded lumbar support in ejection seat aircrew with its effectiveness in other aircrew groups. Details of all currently British military aircrew issued with individually moulded lumbar supports between 1 January 1986 and 31 January 1995 were obtained from records held at the Royal Air Force Aviation Medicine Training Center, where supports have been manufactured since 1976.

Derived from text

*Lumbar Region; Supports; Back Injuries; Flight Crews; Rotary Wing Aircraft; Fixed Wings; Aerospace Medicine*

20000012680 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

**Prediction of Radiological Hazard Areas with HPAC**

Haslip, D. S.; Oct. 1999; 26p; In English

Report No.(s): AD-A371081; DREO-TM-1999-089; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dispersal of radioactive materials in a number of military scenarios has been modelled computationally. This work is part of an international intercomparison of computational capabilities under the auspices of Action Group 44 of The Technical Cooperation Program. The results presented herein were obtained with the Hazard Prediction and Assessment Capability (HPAC), designed by the U.S. Defense Threat Reduction Agency (DTRA). This sophisticated software can be used to quickly determine the extent of radiological hazard areas, requiring a relatively small quantity of information from the user. The potential of this software for applications such as pre-deployment preparation, or even pseudo real time hazard prediction with input from hand held radiation detection equipment must be recognized.

DTIC

*Applications Programs (Computers); Radiation Hazards; Radiation Measurement; Computer Techniques*

20000012787 Army Research Inst. of Environmental Medicine, Natick, MA USA

**Orthostatic Tolerance During  $\alpha$ -Adrenergic Receptor Blockade at High Altitude**

Fulco, C. S.; Muza, S. R.; Rock, P. B.; Matthews, D. O.; Kambis, K. W.; Nov. 1999; 30p; In English

Contract(s)/Grant(s): DAMD-17-95-C-5110

Report No.(s): AD-A371160; USARIEM-TR-T00-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the first two weeks of high altitude (HA) exposure, blood pressure typically rises due, in part, to a large increase in sympathetic stimulation. We hypothesized that blocking  $\alpha$ -adrenergic receptors would impair circulatory compensation to an orthostatic challenge to a greater extent at HA than at sea level (SL). Sixteen healthy women (23 +/- 2 yr) were randomly assigned to receive either 2 mg prazosin (n = 8) or placebo (n = 8) t.i.d. (double-blind design) for 12 d at SL and during the first 12 d of HA residence (4300 m). Passive 60 deg. upright tilt was performed at SL (10 d of treatment), and after 3 and 10 d at HA. Mean arterial blood pressure (MBP, auscultation) and heart rate (HR, ECG) were measured every min during 10 min each of supine rest and tilt. For the prazosin group compared to the placebo group: (1) At SL, supine and tilt MBP were lower (P is less than 0.05) and, at HA, MBP was lower only in the first several min of tilt on day 10 (P is less than 0.05); (2) At SL or HA, HR was similar for either position; and (3) From supine to tilt, the drop in MBP was greater only at SL and the increase in HR was consistently greater only at HA (both P is less than 0.05). We conclude that  $\alpha$ -adrenergic blockade altered MBP and HR responses to tilt at SL and HA, but that orthostatic tolerance was well maintained in both environments. Compensatory adjustments were likely in either sympathetic and parasympathetic neural discharge or in other receptor activities.

DTIC

*Heart Rate; Circulation; Sympathetic Nervous System; Blood Pressure; Orthostatic Tolerance; Antiadrenergics*

20000013287 Fourth Military Medical Univ., Dept. of Aerospace Biodynamics, Xi'an, China

**Effect of Repeated Cerebral Ischemia Induced by Lower Body Negative Pressure on Neuronal Morphology and Ions Contents, ATPase Activity of Brain Tissue in Rats**

Sun, Xi-Qing, Fourth Military Medical Univ., China; Jiang, Shiz-Hong, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Yao, Yong-Jie, Fourth Military Medical Univ., China; Zhang, Li-Fan, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 420-424; In Chinese

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

To investigate the effect of repeated +Gz -induced loss of consciousness on the brain and its mechanism, we observed the changes of ions contents, ATPase activity of brain tissues and neuronal morphology after repeated cerebral ischemia induced by lower body negative pressure (LBNP) in rats. Thirty male Sprague - Dawley rats were divided into 3 groups randomly. Rats were anesthetized and exposed to LBNP of -4 kPa at a rate of 0.67 kPa/s. The pressure rapidly returned to control level 2 min after Electroencephalography (EEG) becomes isoelectric. Cortical Na(+) - K(+) - ATPase activity decreased significantly 1 h after one LBNP exposure (P is less than 0.05), While Na(+), K(+) and water contents of brain tissues showed a tendency to increase (P is greater than 0.05). Na(+) - K(+) - ATPase activity decreased significantly while Na(+), K(+) and water contents increased significantly 1 h after three LBNP exposures, and ischemic changes were found in a few neurons. It suggested that three cerebral ischemia exposure induced by LBNP can result in disturbance of ion homeostasis and neuronal damage.

Author

*Aerospace Medicine; Cerebrum; Ischemia; Lower Body Negative Pressure; Morphology; Ions*

20000013291 Air Force Convalescent Hospital, Qingdao, China

**Effects of Vestibular Stimulus on Heart Rate Variability**

Tian, Guang-Qing, Air Force Convalescent Hospital, China; Yu, Yao-Rong, Air Force Convalescent Hospital, China; Hu, Su-

Wei, Air Force Convalescent Hospital, China; Bai, Gang, Air Force Convalescent Hospital, China; Gu, Ying, Air Force Convalescent Hospital, China; Gai, Yu-Qing, Air Force Convalescent Hospital, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 401-405; In Chinese

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

Possible effects of vestibular stimulation autonomic nerve function in pilots were studied by observing changes of Heart Rate Variability (HRV). Time domain and frequency domain analyses demonstrated that the primarily averages, standard deviation of the HRV averages (SD), least or greatest value, deviation of greatest minus least value, interrelated averages, square root of the mean of the sum of squares of differences between adjacent R - R intervals (RMSSD), total power (TP), low frequency (LF), high frequency (HF), LF/TP, HF/TP, and LF/HF all had significant increase or decrease (P is less than 0.05 - is less than 0.01) and the degrees of changes were related to the intensity of the stimulations.

Author

*Aerospace Medicine; Heart Rate; Variability; Vestibules; Stimulation; Heart Function*

20000013352 Air Force General Hospital, Beijing, China

**Analysis of Time Domain and Frequency Domain Heart Rate Variability in Fighter Pilot Before and After Upright Tilt**

Wang, Lu-Jin, Air Force General Hospital, China; Wu, Liu-Xin, Air Force General Hospital, China; Ji, Gui-Ying, Air Force General Hospital, China; Zhang, Xiang-Yao, Air Force General Hospital, China; Chen, Tong-Xin, Air Force General Hospital, China; Wang, Ling, Air Force General Hospital, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 451-454; In Chinese

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

Effects of upright tilt on mechanism of autonomic nervous regulation of cardiovascular system and characteristics of heart rate variability (HRV) were observed in sixty healthy male pilots. Relation between time domain and frequency domain indexes of short time HRV (5 min) were analyzed before and after upright tilt. The results showed that there are significant difference in short time HRV parameters before and after upright tilt. Significant relationship was formed between time domain and frequency domain indexes of HRV. It suggests that time domain and frequency domain HRV analysis is capable of revealing certain informations embedded in a short series of R - R intervals and can help to evaluate the status of autonomic' regulation of cardiovascular function in pilots.

Author

*Aerospace Medicine; Frequency Domain Analysis; Time Domain Analysis; Heart Rate; Variability*

20000013353 Air Force General Hospital, Dept. of Otolaryngology, Beijing, China

**Relation Between Submucosal Cyst of Maxillary Sinus and Flying**

Xu, Xian-Rong, Air Force General Hospital, China; Liu, Hua-Feng, Air Force General Hospital, China; Li, Shuang-Sheng, Air Force General Hospital, China; Zeng, Wei-Dong, Air Force General Hospital, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 444-446; In Chinese

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

Case studies of submucosal cyst of maxillary sinus were made in 15 pilots. The results showed: Among 7 cases with symptoms, 6 were operated. Except for one who was permanently grounded after operation, the other five together with one who was not operated are still in a qualified position to continue their flying job; among 8 cases found in physical examination for changing equipment, one was operated and was found to be normal by hypobaric chamber test (HOCT) after operation and was qualified through the physical examination for changing equipment. Among the other 7 nonoperated cases, 4 passed the physical examination for changing equipment and 3 failed. It suggests that symptomatic cases of submucosal cyst of maxillary sinus may still be qualified for flying the previous type of aircrafts provided they are found normal by HOCT after treatment. Those suffering from simple minor submucosal cyst of maxillary sinus with no obvious symptom may still be qualified to fly aircrafts of higher performance if they pass the examinations including HOCT.

Author

*Aerospace Medicine; Cysts; Sinuses; Tasks*

20000013360 Institute of Space Medico-Engineering, Beijing, China

**Heart Rate Variability Analysis Under Lower Body Negative Pressure**

Yang, Jing-Sheng, Institute of Space Medico-Engineering, China; Zhao, Guo-Xuan, Institute of Space Medico-Engineering, China; Zhong, Chong-Fa, Institute of Space Medico-Engineering, China; Hu, Zhi-Hong, Institute of Space Medico-Engineering, China; Lu, Li-Li, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 430-434; In Chinese

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

In order to assess the changes of HRV in relation to hemodynamic responses to LBNP, 40 healthy male volunteers were exposed to progressively increasing LBNP. Changes of SV, CO and BP were measured and HRV was analyzed. Thirty-four subjects(Group A, with good tolerance) were able to tolerate all stages of LBNP, and other 6 subjects(Group B, with poor tolerance) showed presyncopal signs and symptoms during the last 5 min of LBNP exposure. In both groups, HRV, SV, CO decreased significantly during LBNP. Group B had lower HRV, SV, CO than group A pre - LBNP, during - LBNP and post - LBNP. The LF/HF ratio increased during LBNP in both groups, but increased more apparently in group B than group A at -6.7 kPa LBNP. The results showed that, when SV decreased to a certain degree, the sympathetic activity increased to the utmost. The onset of presyncopal signs could be attributed to the rapid withdrawal of sympathetic tone, and LBNP tolerance of a subject is closely related to both ejecting capability of the heart and the function of autonomic nervous system .

Author

*Aerospace Medicine; Heart Rate; Variability; Lower Body Negative Pressure; Heart Function*

20000013646 Osaka City Univ., Faculty of Engineering, Japan

*A Study on the Precision of the Depth Measurement with View Directions of Human Eyes*

Yanagihara, Yoshio, Osaka City Univ., Japan; Hama, Hiromitsu, Osaka City Univ., Japan; *Memoirs of the Faculty of Engineering: Osaka City University; December 1999; ISSN 0078-6659; Volume 40, pp. 99-104; In English; No Copyright; Avail: Issuing Activity, Hardcopy*

Selecting an object in a 3-dimensional space is more useful for a human interface. The depth is easily calculated by stereography with view directions of both eyes. However, human eyes include the vibration. We discussed the affect of the small vibration of human eyes to the depth measurement theoretically and estimated its quantity with the measured value of the small vibration in the experiment. From the experiment result, it is pointed out that the neighboring objects on the depth of 300(mm) are good discriminative, though the neighboring objects on the depth of 3000(mm) are not sufficiently discriminative.

Author

*Depth Measurement; Human-Computer Interface; Stereoscopic Vision*

20000013894 Health Research, Inc., Rensselaer, NY USA

*Determinants of Stress Fracture and Bone Mass in Elite Military Cadets Annual Report, 15 Jul. 1998 - 14 Jul. 1999*

Cosman, Felicia, Health Research, Inc., USA; August 1999; 25p; In English

Contract(s)/Grant(s): DAMD17-98-1-8539

Report No.(s): AD-A369280; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The determinants of peak bone mass and stress fracture risk are of both immediate and long-term interest to the military community. Research in these areas is being conducted on the class of 2002 over a four-year period at the USA Military Academy. In this study we have recruited 891 cadets (752 males and 139 females). The data collected to date include baseline historical information (including dietary calcium intake, menstrual function and past fracture history), baseline blood samples baseline and year 1 bone densitometry. and interval surveys over the first year at USMA regarding physical activity, menstrual function and dietary habits as well as stress fracture occurrence. The bone densitometry tools used included peripheral Dual xray absorptiometry (Lunar PIXI) for heel measurements (n=880), peripheral Quantitative Computed Tomography (Norland pQCT) which measures total and cortical tibial bone density (n=7) and a mobile central dual xray absorptiometer (Lunar DPX-IQ) for bone density of the lumbar spine and hip (n=300). Calcaneal BMD was on average one standard deviation higher than MID in both male and female cadets than the age and gender matched general population. Determinants of heel BMD included normal menses, in female and exercise levels and milk consumption in male cadets. Women had a higher incidence of stress fracture ( 12.2 % versus 3.5 % in males during 9 months at USMA). The etiology for stress fractures for males and females appeared to differ. In women with fractures, BMD at the heel spine and hip were all lower than in women without fractures. In men, heel BMD did not discriminate cadets with fracture versus those without, however, cortical thickness of the tibia was a major predictor of stress fracture risk.

Author

*Bones; Bone Mineral Content; Joints (Anatomy); Fractures (Materials); Fracturing; Stress Functions*

20000013942 Veda, Inc., Alexandria, VA USA

*Radiofrequency Electromagnetic Fields (RFEMF) and Cancer: A Comprehensive Review of the Literature Pertinent to Air Force Operations Interim Report, Jan.-Jul. 1998*

Heynick, Louis N.; Jun. 1999; 198p; In English

Contract(s)/Grant(s): F41624-96-C-9009; AF Proj. 7757

Report No.(s): AD-A370747; AFRL-HE-BR-TR-1999-01445; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Analyzed herein are the research studies on whether an association exists between the incidence or promotion of cancer and exposure to radiofrequency electromagnetic fields (RFEMF) in the nominal frequency region from 3 kHz to 300 GHz. Among the topics discussed are RFEMF and cancer in humans, including epidemiologic/occupational studies of populations actually exposed, or presumed to have been exposed to RFEMF, based on occupational titles or analogous considerations; in vivo and in vitro studies seeking cancer induction or promotion in mammals and mammalian tissues; and studies toward determining whether RFEMF is mutagenic or genotoxic to microorganisms or fruit flies. The findings of the studies on each topic are summarized in tabular form. Preceding those topics is a discussion of the need for using scientific criteria to assess the credibility of the findings of the various studies with regard to any potential risk to human health. Also presented are summaries of past and current exposure guidelines for human exposure to RFEMF. The overall conclusion of the analyses is that there is no scientifically valid basis for the existence of a causal linkage between RFEMF exposure and cancer incidence or promotion.

DTIC

*Military Operations; Epidemiology; Electromagnetic Fields; Electromagnetic Radiation; Exposure; Cancer*

20000014068 Johns Hopkins Univ., Laurel, MD USA

**Approaches to MRI Gating Using Multiple Sensors**

Iannuzzelli, Russell J., Johns Hopkins Univ., USA; Morgan, Patrick N., Johns Hopkins Univ., USA; Kluga, Bernard E., Johns Hopkins Univ., USA; Rockwell, Michelle M., Johns Hopkins Univ., USA; Johns Hopkins APL Technical Digest; 1999; Volume 20, No. 2, pp. 143-156; In English

Report No.(s): AD-A36521; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

High-resolution images of the heart and coronary arteries produced by magnetic resonance imaging (MRI) typically require acquisition over multiple heart cycles. The goal of the work reported here was to develop an improved method of imaging coronary arteries using MU that would minimize image artifacts caused by motion. We obtained information from a variety of sensors, including some that had never before been applied to MRI. This article gives a detailed description of our efforts to meet the stated goal.

Author

*Arteries; Coronary Circulation; Heart; Imaging Techniques; Magnetic Resonance; Telemetry; Cardiovascular System; Multi-sensor Applications*

20000014074 Army Research Inst. of Environmental Medicine, Thermal and Mountain Div., Natick, MA USA

**Thermoregulatory Adaptations to Circadian Timekeeping and Sleep Disturbance, Chapter 30**

Stephenson, Lou A., Army Research Inst. of Environmental Medicine, USA; Adaptation Biology and Medicine; 1999; Volume 2, pp. 322-332; In English

Report No.(s): AD-A368501; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Biological clocks communicate temporal information to every mammalian homeostatic system, including temperature and sleep regulation. The specific impact of the circadian timing system (CTS) on temperature regulation and sleep in humans has been studied, but the mechanisms communicating circadian period to each regulatory system are not yet known. The objectives of this review are to: (1) describe the mammalian circadian clock and its known signaling pathways; (2) describe sleep and deprivation in the context of the CTS in humans; (3) discuss the effects of sleep deprivation on thermoregulation in light of its effects on CTS; and (4) review the evidence for a mechanism which stimulates a temporal adaptation to a stressor delivered at a specific circadian time.

Derived from text

*Circadian Rhythms; Thermoregulation; Sleep Deprivation; Adaptation; Time Measurement*

20000014126 Army Research Inst. of Environmental Medicine, Thermal and Mountain Medicine Div., Natick, MA USA

**Water and Electrolyte Requirements for Exercise**

Latzka, William A., Army Research Inst. of Environmental Medicine, USA; Montain, Scott J., Army Research Inst. of Environmental Medicine, USA; Clinics in Sports Medicine; July 1999; ISSN 0278-5919; Volume 18, No. 3, pp. 513-524; In English

Report No.(s): AD-A368494; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Maintenance of water and electrolyte balance is important for sustaining cognitive and physical performance. Dehydration degrades morale and desire to work. Body water deficits of as little as 2% body weight can impair physical performance. Water deficits of 5% to 7% body weight are associated with dyspnea, headaches, dizziness, and apathy. Water deficit and salt depletion are also considered significant risk factors for the development of heat illness during hot-weather activities. Excessive overhydration can also be detrimental to cognitive and physical performance. People consuming excessive quantities of water during physical activities can produce a relatively rapid dilution of plasma electrolytes if the kidneys are unable to excrete the excess fluid.

This behavior can result in intracranial swelling and development of "water intoxication" -a syndrome manifested by altered CNS (Central Nervous System) function, nausea, and impaired physical abilities. This article summarizes the water and electrolyte losses during exercise and presents strategies to optimize hydration state before, during, and following exercise. This article is not an exhaustive review of the literature. The reader is referred to several excellent review articles for more information on this topic. The American College of Sports Medicine also recently published a position stand on fluid replacement for exercise.

Author

*Sports Medicine; Physical Exercise; Electrolytes; Water Loss; Central Nervous System; Body Fluids*

20000014128 Army Research Inst. of Environmental Medicine, Thermal and Mountain Medicine Div., Natick, MA USA

**Thermoregulation During Cold Exposure: Effects of Prior Exercise**

Castellani, John W., Army Research Inst. of Environmental Medicine, USA; Young, Andrew J., Army Research Inst. of Environmental Medicine, USA; Kain, James E., Army Research Inst. of Environmental Medicine, USA; Rouse, Amy, Army Research Inst. of Environmental Medicine, USA; Sawka, Michael N., Army Research Inst. of Environmental Medicine, USA; Cold Exposure After Exercise; July 1999, pp. 247-252; In English

Report No.(s): AD-A368492; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

This study examined whether acute exercise would impair the body's capability to maintain thermal balance during a subsequent cold exposure. Ten men rested for 2 h during a standardized cold-air test (4.6 C) after two treatments: 1) 60 min of cycle exercise (Ex) at 55% peak O<sub>2</sub> uptake and 2) passive heating (Heat). Ex was performed during a 35 C water immersion (WI), and Heat was conducted during a 38.2 C WI. The duration of Heat was individually adjusted (mean = 53 min) so that rectal temperature was similar at the end of WI in both Ex (38.2 C) and Heat (38.1 C). During the cold-air test after Ex, relative to Heat 1) rectal temperature was lower (P less than 0.05) from minutes 40-120, 2) mean weighted heat flow was higher (P less than 0.05), 3) insulation was lower (P less than 0.05), and 4) metabolic heat production was not different. These results suggest that prior physical exercise may predispose a person to greater heat loss and to experience a larger decline in core temperature when subsequently exposed to cold air. The combination of exercise intensity and duration studied in these experiments did not fatigue the shivering response to cold exposure.

Author

*Thermoregulation; Physical Exercise; Exposure; Cold Tolerance; Human Body; Sports Medicine*

20000014238 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

**Benefits of Respiratory Heat and Moisture Exchangers during Cold Exposures**

Carnevale, N.; Ducharme, M. B.; Sep. 1999; 51p; In English

Report No.(s): AD-A370499; DCIEM-TR-1999-098; Copyright; Avail: Defense Technical Information Center (DTIC), Hardcopy

The purpose of this paper was to serve as a brief literature review overviewing the current state of knowledge pertaining to respiratory heat and moisture exchangers (HME's). Recommendations were extracted from the review with the intention of informing the Dwyer Hill Training Center so that an informed decision could be made regarding further laboratory testing of HME's as well as setting policy regarding the use of HME's as an ergogenic aid for the Canadian Forces (CF). Detailed for the reader were the general physical properties and mechanism of function of most modern HME's, as well as their application to respiratory heat and moisture retention, reduction of cold and/or exercise induced bronchoconstriction, and medical environments. Although the majority of the papers reviewed reported positive findings-with the only real challenges coming from the medical community-no hard evidence was found to support the use of HME's as an ergogenic aid in the reduction of respiratory heat and moisture loss. However, there may be some merit for the use of HME's as performance enhancers by those individuals who are predisposed to respiratory complications that are further aggravated by cold and/or exercise exposure. In light of the evidence provided by this review, it is the recommendation of the authors that further more specific and thorough testing be commissioned to evaluate the heat and moisture sparing properties of HME's and their possible application as an ergogenic aid to CF personnel during cold exposure. We do feel comfortable however with recommending HME use by those military personnel who have existing respiratory conditions that might be aggravated by cold and/or exercise exposure.

DTIC

*Exposure; Moisture; Respiration; Cold Weather; Aerospace Medicine*

20000017934 Navy Experimental Diving Unit, Panama City, FL USA

**Use of Emergency Evacuation Hyperbaric Stretcher (EEHS) in Submarine Escape and Rescue**

Latson, Gary W.; Flynn, Edward T., Jr.; Oct. 1999; 50p; In English

Contract(s)/Grant(s): Proj-S0099

Report No.(s): AD-A371262; NEDU-TR-4-99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Navy identified a need for portable and collapsible one-man hyperbaric chambers, called Emergency Evacuation Hyperbaric Stretchers (EEHS), which could be used as a means of transporting submarine rescues suffering from Decompression Sickness (DCS) or Arterial Gas Embolism (AGE) to a recompression chamber for treatment. This report discusses the possible uses of such a system in the U.S. Navy Submarine Rescue Mission. Medical indications and contraindications for use of the system are reviewed. Characteristics of the currently favored system are described. Triage algorithms and treatment guidelines are presented for submarine escape, submarine rescue, and evacuation using the EEHS. The EEHS represents a significant advance in acute management of distressed submarine casualties, but many logistical issues will require careful consideration and planning.

DTIC

*Decompression Sickness; Hyperbaric Chambers; Emergencies; Evacuating (Transportation); Rescue Operations; Aeroembolism*

20000017950 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

*Effects of Dehydration, Hypohydration, and Hyperhydration on Tolerance During Uncompensable Heat Stress*

McLellan, Tom M., Defence and Civil Inst. of Environmental Medicine, Canada; Cheung, Stephen S., Defence and Civil Inst. of Environmental Medicine, Canada; Latzka, William A., Army Research Inst. of Environmental Medicine, USA; Sawka, Mike N., Army Research Inst. of Environmental Medicine, USA; Pandolf, Kent B., Army Research Inst. of Environmental Medicine, USA; Millard, Claire E., Defence Research Agency, UK; Withey, W. Reg, Defence Research Agency, UK; Canadian Journal of Appl. Physiology; [1999]; Volume 24, No. 4, pp. 349-361; In English

Report No.(s): AD-A369081; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The present study examined the effects of dehydration from prior exercise on subsequent exercise tolerance time (TT) that involved wearing nuclear biological, and chemical (NBC) protective clothing. It was hypothesised that TT would be reduced in the dehydrated state. Ten men undertook continuous treadmill walking at 4.8 km/h at 35°C and 50% relative humidity, wearing NBC clothing while euhydrated (EU) or dehydrated (D) by 2.13% of body weight. Hydration status had no impact on thermoregulatory or cardiovascular responses during exercise. Also rectal temperature at exhaustion did not differ between EU (38.52 +/- 0.39 C) and D (38.43 +/- 0.45 C). Exercise TT during this uncompensable heat stress was reduced significantly for D (47.7 +/- 15.3 min) compared with EU (59.0 +/- 13.6 min). It was concluded that prior exercise leading to levels of dehydration to 2.3% of body weight, together with subsequent fluid restriction during exposure to uncompensable heat stress, impaired TT while wearing the NBC protective clothing. The integration of these findings together with other comparable studies that have examined the influence of hypo- and hyperhydration on TT while wearing NBC protective clothing revealed that hydration status has less effect on TT as the severity of uncompensable heat stress increases,

Author

*Dehydration; Heat Tolerance; Human Beings; Physical Exercise; Physiological Responses; Protective Clothing; Thermoregulation; Water Loss; Body Temperature*

20000017993 Old Dominion Univ., Research Foundation, Norfolk, VA USA

*Commercialization and Industrial Development for the Fetal Heart Rate Monitor Final Report, Period ending 31 Aug. 1999*

Zahorian, Stephen, Old Dominion Univ., USA; January 2000; 16p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2123

Report No.(s): ODURF-191331; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objectives for this task were to continue the development and testing of the NASA/ODU passive acoustic fetal heart rate monitor, with the goal of transferring the technology to the commercial sector. Areas of work included: 1. to assist in the development of a new hardware front end electronics box for the fetal heart rate monitor, so as to reduce the size of the electronics box, and also to provide for a "low-frequency" and "high-frequency" mode of operation. to make necessary changes in the operating software to support the two modes of operation. 2. to provide an option for a strip chart recording for the system, so that medical personnel could more easily make comparisons with ultra sound strip chart recordings. and 3. to help with continued testing of the system.

Author

*Product Development; Fabrication; Performance Tests; Monitors; Measuring Instruments; Heart Rate*

## BEHAVIORAL SCIENCES

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

20000011736 Headquarters Army Aviation, Middle Wallop, UK

**Controlling the Hazard of Spatial Disorientation in Rotary-Wing Operations by Enhanced Training**

Braithwaite, M. G., Headquarters Army Aviation, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 1-1 - 1-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Spatial Disorientation (SD) remains an important source of attrition in military flying. Several recent symposia and technical meetings have recommended various initiatives to control this hazard such as education training research and technological improvements. This paper gives details of the various training initiatives that have been established through the Technical Working Group (TWO) of the Triservice Aeromedical Research Panel. and the international forum of Working Pam: 61 of the Air Standardization Coordinating Committee (ASCC). Nations and individual services were asked to contribute to a panel to consider how the hazard of SD could best be controlled by means of training enhancements. All aspects of existing and potential training were reviewed: classroom instruction ground based demonstrations and training in both dedicated SD demonstrators and flight simulators. in flight demonstration and training, SD training for special forms of flight; and training the SD trainers. It was clear from this review that many improvements were required, and that most could readily be adopted. It must be remembered that training is not necessarily the only? or even the preferred solution to the various problems associated with SD. Nevertheless, where training can help, it must be regarded as the most readily applied control. The most specific enhancement identified was to make SD training more "experienced-based." This essentially implies more simulator and in-flight demonstrations and better SD preventive and management procedures.

Author

*Aerospace Medicine; Disorientation; Psychological Effects; Human Factors Engineering; Flight Simulators; Education; Rotary Wing Aircraft*

20000011739 Royal Norwegian Inst. of Aviation Medicine, Oslo, Norway

**A Systems Approach to Selection and Training of Aircrew to the Air Ambulance Service**

Fonne, Vivianne, Royal Norwegian Inst. of Aviation Medicine, Norway; Myhre, Grete, Royal Norwegian Inst. of Aviation Medicine, Norway; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 4-1 - 4-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Emergency Medical Services are recognized world wide for its highly qualified personnel, well known for their dedication and motivation to the service. Even so, regulatory practice in Air Ambulance Services varies from country to country offering different solutions to the issues of crew composition and qualification in order to ensure safe and efficient operations. The definition of crew and issues of selection and training from a systems perspective, involves in-depth discussions on the relative impact of regulatory, as well as organizational practices. One argues the need for greater regulatory commitment in developing criteria for selection and training of aircrew to the service. In addition, one suggests that in order to arrive at A,ell documented criteria in which all can agree, it is considered vital to involve all parts of the system in this process. Secondly, the question is raised whether one should be limited to a dedicated service for primary and secondary aeromedical transportation or whether one should allow for other non-medical transport missions as well. The choice of operational model will have obvious consequences for the crew concept chosen. The role of new technology in increasing safety in the Air Ambulance Service is included in the discussion, particularly in relation to choice of operational model, choice of crew composition as well as in relation to crew training requirements.

Author

*Aerospace Medicine; Flight Crews; Air Transportation; Medical Services; Human Factors Engineering*

20000011745 Textron Bell Helicopter, Fort Worth, TX USA

**An Analysis of the Impact of Chemical/Biological Warfare Environments on Aviation Crewmember Cockpit Performance**

Taylor, Robert R., Textron Bell Helicopter, USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 12-1 - 12-11; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In 1995 and 1996 Bell Helicopter Textron conducted studies to determine the effect of NBC environments on aircraft cockpits and on aircrew performance. Two of the studies concentrated on: 1. Determining the build up rates inside small non hardened helicopter cockpits and 2. Determining the effects of the chemical protective clothing individual components on aircrew performance. The first study was used to determine the performance requirements for chemical detection systems. The second study was used to identify the short comings of existing chemical suits used by aviators and quantify those shortcomings in order to recommend improvements in future designs. The studies were intended to be generic in nature and apply to non-hardened scout

type aircraft. The first study used the cockpit specifications and ventilation systems of a Jet Ranger type aircraft to determine the expected build up rates of chemical agents in the cockpit given a specific exterior contamination level. The task lists and manuals for the OH58 D Kiowa helicopter were used to provide input data for the Task and Workload analysis in the second study. The build up study determined the rate at which agent built up in the cockpit. These data were plotted against the casualty effects of the specific agent as reported in standard military field manuals, and the exposure times were used to calculate the sensor response time requirements. The requirements were for the sensors to provide the crew adequate warning in both point and remote sensing modes. If adequate warning can be provided, aircrews can fly into suspected contamination areas in a lower protective posture and, as the warning is provided, they can maneuver to avoid the contamination or increase the personal protection to a higher level. For example, the crew may fly with protective mask off and the protective suit open to provide cooling and until the moment the protection is required. This capacity can improve both mission endurance and crew efficiency. This paper reports briefly the methodology used and the expected effects of one specific agent, and reports in detail on the methodology and the results of a human performance modeling analysis.

Derived from text

*Chemical Warfare; Protective Clothing; Workloads (Psychophysiology); Cockpits; Human Factors Engineering; Aircraft Pilots; Human Performance*

20000011748 Army Aeromedical Research Lab., Fort Rucker, AL USA

*Assessment of Simulated Spatial Disorientation Scenarios in Training US Army Aviators*

Johnson, P. A., Army Aeromedical Research Lab., USA; Estrada, A., Army Aeromedical Research Lab., USA; Braithwaite, M. G., Headquarters Army Aviation, UK; Manning, J. C., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 15-1 - 15-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Spatial disorientation (SD) is considered to be present when a pilot fails to perceive the position, motion, or attitude of his/her aircraft with respect to the gravitational vertical or surrounding objects. The results of SD in flight may be disastrous. The limitation of ground based training to raise the aviator's awareness of SD is widely acknowledged. A proposal was therefore raised to develop SD scenarios for presentation in a visual flight simulator. The scenarios were developed using accident summaries from the US Army Safety Center (USASC), Fort Rucker Alabama, which were reviewed for suitable content. These were then presented as a series of scripts from which a trainer could reproduce the situation in a visual flight simulator. The resulting scenarios were presented to 30 experienced aviators who completed questionnaire evaluations after each scenario and an overall evaluation. The results showed a high level of acceptance of this training tool by a group of experienced aviators with differing backgrounds. The scenarios have since been developed as a U.S. Army aviation training tool and are being distributed to units worldwide. The scenarios were developed in a UH-60 (Blackhawk) simulator, but have been refined to make them relevant to other types of helicopter operation, such as the AH64 (Apache) attack helicopter

Author

*Flight Simulators; Aircraft Pilots; Disorientation; Human Factors Engineering; Education; Aerospace Medicine; Armed Forces (USA)*

20000011750 Centro de Instruccion de Medicina Aeroespacial, Madrid, Spain

*Fear of Flying in SPAF Helicopter Aircrew*

Cruz, Jesus Medialdea, Centro de Instruccion de Medicina Aeroespacial, Spain; Tejada, Francisco Rios, Centro de Instruccion de Medicina Aeroespacial, Spain; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 17-1 - 17-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this retrospective work have studied Fear of Flying in a group of SPAF (Spanish Air Force) helicopter aircrew. We analyze the frequency of phobia to flight, its relation with aircraft accidents and flight motivation, as well as the presence of other psychiatric diseases and therapeutic attitudes.

Author

*Fear of Flying; Flight Crews; Human Factors Engineering; Aerospace Medicine; Helicopters*

20000011751 Army Aeromedical Research Lab., Fort Rucker, AL USA

*Assessment of Aircrew Stress*

Katz, Lawrence C., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 18-1 - 18-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The belief systems associated with the aviator personality may not be optimal for coping with interpersonal stresses, and thus could be the target of intervention in a proactive attempt to prevent the 'failing aviator' syndrome. This study assessed members

of a U.S. Army medical evacuation unit in terms of their stressors, current coping styles, thought patterns, and symptoms suggesting difficulties in coping. Respondents' perceived lack of work rewards, ongoing relational pressures, pessimism and resentment were found to be related to physical, emotional, and behavioral symptoms. This study suggests a potential preventative approach to stress management training with military aviators using cognitively oriented interventions.

Author

*Human Factors Engineering; Emotional Factors; Stress (Psychology); Aerospace Medicine; Flight Crews; Aircraft Pilots*

20000011759 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

**Simulator Versus in-Flight Measurement of Pilot Performance**

Caldwell, J. A., Army Aeromedical Research Lab., USA; Roberts, K. A., Army Aeromedical Research Lab., USA; Jones, H. D., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 27-1 - 27-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A quasi-experimental approach assessed the comparability of simulator versus in-flight results. Flight data from three sleep deprivation studies were pooled. Twenty aviators were included, 10 who flew a UH-60 helicopter simulator and 10 who flew a UH-60A aircraft under the influence of Dexedrine, or placebo during 40 hours of continuous wakefulness. Performance on straight and levels, right and left turns, climbs and descents, and a left-descending turn (assessed at 0100, 0500, 0900, 1300, and 1700) tended to correspond in the simulator and aircraft. Generally, performance under Dexedrine was better than under placebo. However, only half of the maneuvers showed consistent, statistically significant stimulant/fatigue effects in both flight platforms. Measurement sensitivity was lower in the aircraft, likely because of error variance due to environmental influences (weather, temperature, and turbulence) and other factors (radio traffic and anxieties about safety). Thus, actual in-flight studies, while desirable in terms of face-validity, underestimate the impact of stressors such as fatigue on pilots.

Author

*Pilot Performance; In-Flight Monitoring; Computerized Simulation; Aerospace Medicine; Sleep Deprivation; Aircraft Pilots; Human Factors Engineering*

20000011760 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

**The Effects of Exercise Versus Napping on Alertness and Mood in Sleep-Deprive Aviators**

LeDuc, P. A., Army Aeromedical Research Lab., USA; Caldwell, J. A., Army Aeromedical Research Lab., USA; Ruyak, P. S., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 28-1 - 28-10; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A quasi-experimental approach assessed the comparability of exercise versus napping for maintaining alertness in aviators deprived of sleep. Subjective and objective data from two sleep-deprivation studies were pooled. Thirty aviators were included, 18 who were given zolpidem induced naps during the deprivation period and 12 who exercised during 40 hours of continuous wakefulness. Performance on Repeated Tests of Sustained Wakefulness, Profile of Mood State questionnaires, and Visual Analogue Scales was assessed. Zolpidem-induced naps were superior to rest in sustaining mood, and alertness on both a subjective and objective test. Napping was also clearly better than exercise for attenuating changes in mood and subjective alertness typically produced by sleep loss.

Author

*Sleep Deprivation; Physical Exercise; Alertness; Aircraft Pilots; Human Factors Engineering; Analogs; Sports Medicine*

20000012919 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Assessment of Simulated Spatial Disorientation Scenarios in Training U.S. Army Aviators *Final Report***

Johnson, Philip A.; Estrada, Arthur; Braithwaite, M. G.; Manning, J. C.; Nov. 1999; 12p; In English

Contract(s)/Grant(s): Proj-3M162787A879

Report No.(s): AD-A371230; USAARL-RN-2000-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spatial disorientation (SD) is considered to be present when a pilot fails to perceive the position, motion, or attitude of his/her aircraft with respect to the gravitational vertical or surrounding objects. The results of SD in flight may be disastrous. The limitation of ground based training to raise the aviator's awareness of SD is widely acknowledged. A proposal was therefore raised to develop SD scenarios for presentation in a visual flight simulator. The scenarios were developed using accident summaries from the U.S. Army Safety Center (USASC), Fort Rucker, Alabama, which were reviewed for suitable content. These were then presented as a series of scripts from which a trainer could reproduce the situation in a visual flight simulator. The resulting

scenarios were presented to 30 experienced aviators who completed questionnaire evaluations after each scenario and an overall evaluation.

DTIC

*Flight Simulators; Flight Training; Training Devices; Visual Flight; Aircraft Pilots; Disorientation*

20000013293 Academia Sinica, Inst. of Genetics, Beijing, China

*Influence of Space Conditions on Photosynthetic Pigment Contents and Chloroplast Ultrastructure of Maize Leaves*

Li, Sherong, Academia Sinica, China; Liu, Min, Academia Sinica, China; Wang, Yong-Xiang, Academia Sinica, China; Yanan, Academia Sinica, China; Zhang, Chun-Hua, Academia Sinica, China; Zeng, Meng-Qian, Academia Sinica, China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 396-400; In English

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

Dried seeds of maize inbred lines were carried by recoverable satellite to space conditions at an altitude of 175-253 km from sea level for 15 d. The effects of space flight on ultrastructure and photosynthetic pigment contents of maize leaves were studied. Various changes in structure were observed. Chloroplast envelope membrane notch, swelling of thylakoids, less granum stacks and stroma thylakoid membranes, and changes of chloroplast contour were often seen. The contents of chlorophyll a, chlorophyll b, and chlorophyll a + b and carotenoids tended to be lower, but Ca/Cb ratio tended to be higher in the leaves from space flight maize in comparison with ground control.

Author

*Photosynthesis; Chloroplasts; Exobiology; Leaves; Aerospace Environments; Plants (Botany); Seeds*

20000013354 Fourth Military Medical Univ., Dept. of Psychology, Xi'an, China

*Validity of Sternberg Dualtask in Evaluating Flight Ability and Effect of Educational Factor*

Miao, Dan-Min, Fourth Military Medical Univ., China; Bai, Yan-Qiang, Fourth Military Medical Univ., China; Zhang, Qi-Ji, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Dec. 1998; ISSN 1002-0837; Volume 11, No. 6, pp. 439-443; In Chinese

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

Validity of the Sternberg dualtask (tracking task and remember) for evaluating flight ability of military pilots, and the influencing factors were studied in 112 grade pilots with different educational levels, ages and kinds of planes. The evaluations of their flight ability were made by their leaders using the multiple - criterion evaluation system. The results showed: the Sternberg dualtask can be used to evaluate the abilities of rapid reaction of operating fighters; the influence of the educational level and age should be considered during evaluating flight ability. It suggests that the Sternberg dualtask is very effective in evaluating flight ability, and it shows that fighter pilots with high educational level, age from 25 to 29, are best candidates for astronauts in China.

Author

*Tasks; Tracking (Position); Pilot Training; Human Reactions*

20000015408 Transportation Safety Associates, Silver Spring, MD USA

*Ocular Measures of Driver Alertness: Technical Conference Proceedings*

Carroll, R. J.; Sep. 20, 1999; 184p; In English; Ocular Measures of Driver Alertness, 26-27 Apr. 1999, Herndon, VA, USA

Report No.(s): PB2000-101412; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report presents the proceedings of a technical conference on ocular measures of driver alertness, sponsored by the Federal Highway Administration (FHWA) Office of Motor Carrier and Highway Safety and the National Highway Traffic Safety Administration (NHTSA) Office of Motor Carrier and Highway Safety and the National Highway Traffic Safety Administration (NHTSA) Office of Vehicle Safety Research. The purpose of this conference was to (1) share recent FHWA/NHTSA findings regarding the validity of eye-based measures of driver alertness, (2) share recent FHWA and NHTSA technology developments in this area, (3) identify and provide information about other Research and Technology studies relevant to in-vehicle alertness monitoring, (4) review the overall state-of-the-art of in-vehicle alertness monitoring, (5) review concepts for feedback of alertness information to drivers and other proposed features of driver-vehicle interface, and (6) review concepts for the successful and user-acceptable introduction of in-vehicle alertness monitoring systems to commercial motor carrier fleets.

NTIS

*Conferences; Alertness*

20000017960 Tuskegee Inst., Aerospace Science Engineering Dept., AL USA  
*Team Training and Retention of Skills Acquired Above Real Time Training on a Flight Simulator Final Report, 19 Nov. 1997 - 30 Oct. 1999*

Ali, Syed Friasat, Tuskegee Inst., USA; Guckenberger, Dutch, SDS International, Inc., USA; Crane, Peter, Air Force Research Lab., USA; Rossi, Marcia, Tuskegee Inst., USA; Williams, Mayard, Tuskegee Inst., USA; Williams, Jason, Tuskegee Inst., USA; Archer, Matt, SDS International, Inc., USA; January 2000; 26p; In English

Contract(s)/Grant(s): NAG4-133; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Above Real-Time Training (ARTT) is the training acquired on a real time simulator when it is modified to present events at a faster pace than normal. The experiments related to training of pilots performed by NASA engineers (Kolf in 1973, Hoey in 1976) and others (Guckenberger, Crane and their associates in the nineties) have shown that in comparison with the real time training (RTT), ARTT provides the following benefits: increased rate of skill acquisition, reduced simulator and aircraft training time, and more effective training for emergency procedures. Two sets of experiments have been performed; they are reported in professional conferences and the respective papers are included in this report. The retention of effects of ARTT has been studied in the first set of experiments and the use of ARTT as top-off training has been examined in the second set of experiments. In ARTT, the pace of events was 1.5 times the pace in RTT. In both sets of experiments, university students were trained to perform an aerial gunnery task. The training unit was equipped with a joystick and a throttle. The student acted as a nose gunner in a hypothetical two place attack aircraft. The flight simulation software was installed on a Universal Distributed Interactive Simulator platform supplied by ECC International of Orlando, Florida. In the first set of experiments, two training programs RTT or ART7 were used. Students were then tested in real time on more demanding scenarios: either immediately after training or two days later. The effects of ARTT did not decrease over a two day retention interval and ARTT was more time efficient than real time training. Therefore, equal test performance could be achieved with less clock-time spent in the simulator. In the second set of experiments three training programs RTT or ARTT or RARTT, were used. In RTT, students received 36 minutes of real time training. In ARTT, students received 36 minutes of above real time training. In RARTT, students received 18 minutes of real time training and 18 minutes of above real time training as top-off training. Students were then tested in real time on more demanding scenarios. The use of ARTT as top-off training after RTT offered better training than RTT alone or ARTT alone. It is, however, suggested that a similar experiment be conducted on a relatively more complex task with a larger sample of participants. Within the proposed duration of the research effort, the setting up of experiments and trial runs on using ARTT for team training were also scheduled but they could not be accomplished due to extra ordinary challenges faced in developing the required software configuration. Team training is, however, scheduled in a future study sponsored by NASA at Tuskegee University.

Author

*Flight Simulation; Training Simulators; Real Time Operation; Computerized Simulation*

20000017991 Old Dominion Univ., Research Foundation, Norfolk, VA USA  
*Biocybernetic Control of Vigilance Task Parameters Final Report, Period ending 31 Dec. 1999*

Freeman, Frederick G., Old Dominion Univ., USA; February 2000; 32p; In English

Contract(s)/Grant(s): NAG1-2105

Report No.(s): ODURF-183881; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The major focus of the present proposal was to examine psychophysiological variables that are related to hazardous states of awareness induced by monitoring automated systems. With the increased use of automation in today's work environment, people's roles in the work place are being redefined from that of active participant to one of passive monitor. Although the introduction of automated systems has a number of benefits, there are also a number of disadvantages regarding the worker performance. Byrne and Parasuraman (1996) have argued for the use of psychophysiological measures in both the development and the implementation of adaptive automation. While both performance based and model based adaptive automation have been studied, the use of psychophysiological measures, especially EEG, offers the advantage of real time evaluation of the state of the subject. Previous investigations of the closed-loop adaptive automation system in our laboratory, supported by NASA, have employed a compensatory tracking task which involved the use of a joystick to maintain the position of a cursor in the middle of a video screen. This research demonstrated that, in an adaptive automation, closed-loop environment, subjects perform a tracking task better under a negative, compared to a positive, feedback condition. While tracking is comparable to some aspects of flying an airplane, it does not simulate the environment found in the cockpit of modern commercial airplanes. Since a large part of the flying responsibilities in commercial airplanes is automated, the primary responsibility of pilots is to monitor the automation and to respond when the automation fails. Because failures are relatively rare, pilots often suffer from hazardous states of awareness induced by long term vigilance of the automated system. Consequently, the aim of the current study was to investigate the ability of the closed-loop, adaptive automation system in a vigilance paradigm. It is also important to note that tracking involves a continuous, though low level, motor response. Since it is not clear how such activity might affect performance of the adaptive automation

system, it was thought to be important to evaluate how the system functioned when there was minimal motor output by the subjects. The current study used the closed-loop system, developed at NASA-Langley Research Center, to control the state of awareness of subjects while they performed a vigilance task. Several experiments were conducted to examine the use of EEG feedback to control a target dimension used in the task. Changes in a subject's arousal, as defined by specific EEG indexes, produced stimulus changes known to affect task performance. In addition, different electrode sites, compared to previous research, were sampled to determine the optimum configuration with regard to the following criteria: (1) task performance and (2) EEG index.

Derived from text

*Automatic Control; Alertness; Biodynamics; Electroencephalography; Feedback Control; Human Performance; Psychophysiology*

## 54

### MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

*Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..*

20000011738 Centre d'Etudes et de Recherches de Medecine Aerospatiale, Inst. de Medecine Aerospatiale, Bretigny sur Orge, France

*Practice of a Theory Concept of CRM (Cockpit Resource Management) Training for Equipping Military Helicopters De la Theorie a la Pratique; Conception d'un Cours CRM Pour les Equipages d'Helicopteres Militaires*

Grau, J. Y., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Derain, P., LEMP, France; Maugey, B., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Valot, C., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Seynaeve, A., COMALAT, France; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 3-1 - 3-8; In French; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Cockpit Resource Management (CRM) is one of the ways available to improve flight safety. "Human factors" training's are designed for military air crews but due to the absence of international military regulation, there is a large variety of training goals and contents between countries. From the know-how acquired during the design of "Puma" helicopter CRM, guidelines can be given for "human factors" training policy definition and CRM courses design. In conclusion data exchange between countries is proposed by the authors as a way to standardize "human factors" training in order to improve either flight safety and aircrew proficiency multinational missions.

Author

*Military Helicopters; Cockpits; Human Factors Engineering; Resources Management; Pilot Training*

20000011752 Naval Air Warfare Center, Crew Systems Dept., Patuxent River, MD USA

*Safety of Flight and Anthropometry in USA Navy Aircraft*

Yauneridge, William, Naval Air Warfare Center, USA; Kennedy, Greg, Naval Air Warfare Center, USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 19-1 - 19-4; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The US Navy initiated a tri-service effort in 1994 to standardize methods, agree on a population data set representative of the future Department of Defense aviator pool, and map current Navy aircraft cockpits to evaluate crew member accommodation. The Joint Primary Air Training System (JPATS) aircraft was specified to accommodate a much wider range of pilot body sizes than any other aircraft in USN/USAF (USA Navy/USA Air Force) history. The expansion of sizes was in both larger and smaller cockpit critical anthropometric dimensions. Because of the JPATS accommodation implications, initial USN emphasis was directed at the most critical aircraft deemed fighters. USN anticipated a concern for this expanded range of pilots to safely fly these aircraft and a need to re-engineer those aircraft to better meet a Congressional mandate for female accommodation. To address this safety concern the USN initiated the cockpit mapping effort to quantify safe pilot fit in all operational aircraft. USN performs three dimensional computer aided drafting (3D CAD) based cockpit measurements of the accommodation provided by aircraft and measures the clearances, reaches, and field of view for a range of individuals. The end products are: 1) Prediction equations that are used to determine a percentage of a target population that can be expected to be accommodated in a particular aircraft or aircraft pipeline. 2) Aircrew candidate selections for pipeline assignments based on achieving a suitable seat position.

Author

*Navy; Anthropometry; Aircraft Pilots; Flight Safety; Armed Forces (USA); Defense Program; Training Aircraft*

20000011758 Institute for Human Factors TNO, Dept. of Work Environment, Soesterberg, Netherlands

**Ergonomic and Anthropometric Issues of the Forward Apache Crew Station**

Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 26-1 - 26-11; In English; See also 20000011735; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the anthropometric accommodation in the Apache crew systems. These activities are part of a comprehensive project, in a cooperative effort from the Armstrong Laboratory at Wright Patterson Air Force Base (Dayton, Ohio, USA) and TNO Human Factors Research Institute (TNO HFRI) in The Netherlands. The main objective of the project is to develop effective methods for anthropometric accommodation of crew systems, during the design process of military aircraft. As a part of this project the Royal Netherlands Airforce asked TNO for a brief examination of the anthropometric selection criteria used for selection of Apache pilots. The criteria were verified in this examination in order to check their validity and to check if more anthropometric selection criteria were needed.

Author

*Anthropometry; Human Factors Engineering; Crew Workstations; Protective Clothing; Apache Rocket Vehicle; Design Analysis*

20000011761 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK

**Helmet Mounted Displays for the 21st Century: Technology, Aeromedical and Human Factors Issues**

Rood, G. M., Defence Evaluation Research Agency, UK; duRoss, H., Defence Evaluation Research Agency, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 29-1 - 29-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The introduction of Helmet Mounted Sights and Display's into operational aircraft, and the increased mass of the helmets due to the incorporation of the additional image source, optical trains, the combiners/projection system as well as the wiring optical supports etc, and the subsequent changes in centre-of-gravity have all conspired to push the biomechanical safety aspects in the wrong direction. Most current work is in minimizing the mass of these components and lowering the CofG of the head mounted mass by a number of clever design fixes, and this is producing some reductions in helmet or head-mounted mass. The average current flight helmets weigh in the region of 1.5kg (3.3lb), whilst the lightest is in the region of 1.1kg (2.5lb). In some cases these lower masses results in a reduction of impact protection and whilst in some cases, this may be acceptable for operational reasons, reduction in impact safety margins is not generally or widely acceptable. To complete the head mounted weight, the mass of an oxygen mask, at some 300g (0.66lb), must be added. Helmets incorporating displays are of course heavier and the current average mass, excluding oxygen mask, is in the region of 1.9kg, (4.2lb) and 2.2kg (4.8lb) with O2 mask gives an indication of the static loads on the head, counterbalanced by the posterior neck muscles. If the mass and balance targets of future Helmet Mounted Displays systems are to be met, then it is likely that new approaches to integrated helmet design need to be initiated, as the current approach with conventional flying helmets has obvious limitations. By the use of new materials and structures technology, lighter weight helmets can be designed and built that provide improved impact protection and stability, whilst reducing the risk of neck and spinal injury. Protection against the helicopter noise environment and improved communications can be accomplished by active noise reduction systems which are an integral part of the helmet design and this type of helmet design has the potential for incorporating fully integrated NBC (Nuclear Biological Chemical) protection.

Derived from text

*Helmet Mounted Displays; Aerospace Medicine; Biodynamics; Human Factors Engineering; Flight Clothing; Structural Engineering; Mathematical Models*

20000011763 Universal Energy Systems, Inc., Fort Rucker, AL USA

**Effects of Head-Supported Devices on Female Aviators during Simulated Helicopter Rides**

Barazanji, K., Universal Energy Systems, Inc., USA; Alem, N., Army Aeromedical Research Lab., USA; Dodson, J., Universal Energy Systems, Inc., USA; Erickson, B., Army Aeromedical Research Lab., USA; Guerrero, R., Army Aeromedical Research Lab., USA; Reyes, S., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 31-1 - 31-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Researchers at the U.S. Army Aeromedical Research Laboratory (USAARL) recently concluded that weight-moment of head-supported devices (HSDs) worn by male aviators should not exceed 80 Newton-centimeters (N-cm). The goal of this study was to define a safe range of weights and centers of mass of HSD that can be tolerated by female helicopter pilots without affecting their health or degrading their performance. Five subjects were exposed to whole-body vibration while wearing HSD with various mass properties. During exposure, biomechanical head acceleration response was recorded. Head pitch, anterior-posterior, and axial accelerations were measured for 12 different helmet configurations during sinusoidal vertical vibration having a magnitude of 0.45 m/s<sup>2</sup> (exp. 2) and frequencies swept from 2 Hz to 17 Hz at the rate of 0.25 Hz/sec. Preliminary results indicate that head

pitch and axial acceleration levels for female subjects were lower than those for their male counterparts. This may be attributed to gender differences in upper-body anthropometry. The standard deviation of female head accelerations was found to be similar to that of male subjects.

Author

*Aerospace Medicine; Helicopters; Females; Aircraft Pilots; Helmets; Head (Anatomy); Biodynamics*

20000011764 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Past, Present and Future Night Vision Goggles in US Army Aviation**

McLean, William E., Army Aeromedical Research Lab., USA; Rash, Clarence E., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 32-1 - 32-15; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Department of the Army (U.S.) decided to increase night operational effectiveness with night vision devices (NVDs) for use in aviation in 1973. The first fielded NVDs for Army aviation were developed for ground troops and were known as the full faceplate AN/PVS-5 night vision goggle (NVG). In the 25 years that have followed, a number of engineering advancements have greatly improved the performance and mechanical packaging of these devices. For approximately the last 10 years, pilots have been using 3<sup>rd</sup> generation image intensifier (I<sup>3</sup>) technology, which is known as the Aviator's Night Vision Imaging System (ANVIS). Although the basic principle of light amplification with a microchannel plate has not changed, the performance has and is due to the optimization of the components and the electronic designs. The latest NVD developments include wider fields of view (FOVs), increased resolution, reduced halos around lights, improved signal to noise ratios and low light performance. A prototype color vision device has also been demonstrated. This paper updates and condenses previous information on U.S. NVG history.

Author

*Night Vision; Goggles; Armed Forces (USA); Helmet Mounted Displays; Head-Up Displays; System Effectiveness*

20000011772 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Aeromedical and Design Issues of the Helicopter Airbag Restraint System**

McEntire, Joseph, Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 41-1 - 41-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Bodily contact with cockpit structure remains the leading cause of serious and fatal injury in survivable helicopter mishaps. As a countermeasure, the U.S. Army is developing a cockpit airbag system (CABS) for use in the UH-60 Black Hawk as a supplemental restraint system. This program was initially considered a technology transfer effort, transferring automotive airbag technology into the military helicopter cockpit. Unique helicopter crash kinematics caused the performance requirements to diverge from automotive requirements. As a result, many of the technical aspects of the airbag restraint system were readdressed, from airbag fabric selection to sensing the crash. Many design challenges remain, such as accommodating the smallest to largest occupants and determining the "FIRE" thresholds. Finally, the method of assessing system effectiveness must be addressed. Various performance requirements, rationale, lessons learned, and operational issues of the cockpit airbag system are discussed.

Author

*Aerospace Medicine; Air Bag Restraint Devices; Design Analysis; System Effectiveness; UH-60A Helicopter*

20000011773 Universal Energy Systems, Inc., Fort Rucker, AL USA

**Mass and Location Criteria of Head-Supported Devices Using Articulated Total Body Simulations**

Brozoski, Frederick T., Universal Energy Systems, Inc., USA; Mobasher, Amir A., Alabama A & M Univ., USA; McEntire, B. Joseph, Army Aeromedical Research Lab., USA; Alem, Nabih M., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 42-1 - 42-10; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Limits on the mass of head-supported devices (HSDs) and center of mass location were investigated using the biodynamic response of occupant models during simulated helicopter crashes. The articulated total body (ATB) model was used to simulate five different crash pulses, three seat stroking distances, and three HSD masses with the mid-sized Hybrid III manikin as the occupant model. The centers of mass were placed at 49 positions in each of three planes: (1) the mid-sagittal plane of the head, (2) a plane located 3 centimeters to the right of the mid-sagittal plane, and (3) a plane 3 centimeters to the left of the mid-sagittal plane. Moments and forces produced by the ATB simulations at the head-neck interface (occipital condyles) were compared to established injury thresholds to determine the risk of neck injury. Acceptable combinations of head-supported masses and locations

then were established for the given impact conditions. Acceptable HSD mass and location were highly dependent on impact condition and the seat stroke.

Author

*Aircraft Accidents; Helmet Mounted Displays; Biodynamics; Flight Crews; Center of Mass; Computerized Simulation; Bionics*

20000011775 Manitoba Univ., Lab. for Exercise and Environmental Medicine, Winnipeg, Manitoba Canada

**A Portable Rigid Forced-Air Warming Cover For Pre-Hospital Transport of Cold Patients During Rotary Wing Aircraft Search and Rescue**

Giesbrecht, Gordon G., Manitoba Univ., Canada; Pachu, Prithpal, Manitoba Univ., Canada; Xu, Xiao-Jiang, Manitoba Univ., Canada; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 25-1 - 25-3; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Two rigid forced-air warming covers were designed to direct heat to the torso and thighs of normothermic subjects. Subjects were heated with an AC powered heater and either a commercial soft cover or the rigid covers (with the heat input at the head or abdomen). Compared to the soft cover, the rigid covers provided similar heat delivery but a higher mean skin temperature. This new heat delivery system combination may have practical value during evacuation of cold patients in rotary wing aircraft.

Author

*Rotary Wing Aircraft; Coverings; Skin Temperature (Biology); Rescue Operations; Searching; Human Factors Engineering; Heating Equipment*

20000012914 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Flight Evaluation of the Communications Earplug in the OH-58D Helicopter. Part 1. Research Report *Final Report***

Murphy, Barbara A.; Moro, Ben T.; Oct. 1999; 46p; In English

Contract(s)/Grant(s): DAMD17-93-C-3101

Report No.(s): AD-A371212; USAARL-RN-2000-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aviators assigned to OH-58D helicopter operational units participated in an expanded field assessment of the communications earplug (CEP). Characteristics of the CEP have been determined through laboratory and field testing over the past several years. Results of the laboratory studies showed that aviators were protected and provided with speech communications capability. The CEP is a low-cost and simple approach that is readily available for immediate fielding. During FY 98, Project Manager-Aircrew Integrated Systems (PM-ACIS) purchased enough CEPs to outfit all aviators currently assigned to OH-58D operational units. The objective of the purchase was to form a large sample of users for evaluating the effectiveness of the current CEP configuration in solving the problems associated with hearing protection and communication in the OH-58D helicopter. The acceptability of the CEP was assessed by comparison with the helmet systems currently used in the OH-58D helicopter. Comments and responses provided by the volunteers show that the CEP, with some modifications, is a substantial improvement over current systems. With improved cockpit communications, flying becomes less fatiguing and stressful. The CEP performs well during daily missions and is considered a viable solution to the problem of inadequate speech clarity and understanding in the Kiowa Warrior helicopter. Over 90 percent of the participants rated the CEP as having greater overall operational value than the aviator helmet as it is currently used. Aviators view the CEP as a viable solution to the communications problem and feel it should be fielded to all aviation units. Part 1 of this study presents the principal findings in summary form. Part II contains the data-set necessary to allow close inspection of individual subject responses.

DTIC

*Helicopters; Aircraft Pilots; Voice Communication; Ear Protectors; Flight Crews*

20000012915 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Flight Evaluation of the Communications Earplug in the OH-58D Helicopter. Part 2. Questionnaire Data *Final Report***

Murphy, Barbara A.; Moro, Ben T.; Oct. 1999; 103p; In English

Contract(s)/Grant(s): DAMD17-93-C-3101

Report No.(s): AD-A371213; USAARL-RN-2000-05; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Aviators assigned to OH-58D helicopter operational units participated in an expanded field assessment of the communications earplug (CEP). Characteristics of the CEP have been determined through laboratory and field testing over the past several years. Results of the laboratory studies showed that aviators were protected and provided with speech communications capability. The CEP is a low-cost and simple approach that is readily available for immediate fielding. During FY 98, Project Manager-Aircrew Integrated Systems (PM-ACIS) purchased enough CEPs to outfit all aviators currently assigned to OH-58D operational units. The objective of the purchase was to form a large sample of users for evaluating the effectiveness of the current CEP configuration in solving the problems associated with hearing protection and communication in the OH-58D helicopter. The acceptability

of the CEP was assessed by comparison with the helmet systems currently used in the OH-58D helicopter. Comments and responses provided by the volunteers show that the CEP, with some modifications, is a substantial improvement over current systems. With improved cockpit communications, flying becomes less fatiguing and stressful. The CEP performs well during daily missions and is considered a viable solution to the problem of inadequate speech clarity and understanding in the Kiowa Warrior helicopter. Over 90 percent of the participants rated the CEP as having greater overall operational value than the aviator helmet as it is currently used. Aviators view the CEP as a viable solution to the communications problem and feel it should be fielded to all aviation units. Part I of this study presents the principal findings in summary form. Part II contains the data-set necessary to allow close inspection of individual subject responses.

DTIC

*Aircraft Pilots; Flight Tests; Helicopters; Voice Communication; Ear Protectors*

20000012916 Army Aeromedical Research Lab., Fort Rucker, AL USA

**Aircrew Upper Extremity Reaches While Flying the UH-60 Flight Simulator: Risk of Airbag-Induced Injury *Final Report***

Crowley, John S.; Vizcaya, Amate; McEntire, B. J.; Johnson, Philip; Brozoski, Fred; Oct. 1999; 12p; In English

Contract(s)/Grant(s): Proj-30162787A878

Report No.(s): AD-A371214; USAARL-RN-2000-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Inflatable restraints such as airbags are being designed for military helicopters. To investigate the potential for extremity injury during airbag deployment, 1-hour videotapes of 12 U.S. Army Black Hawk pilots flying a training simulator were reviewed. The flights were unmodified training sorties and consisted of instrument and visual flight over varying terrain. Every time the aviator appeared to move outside the resting "flight" position, the nature and destination of the movement were recorded. The total proportion of time spent reaching for various control consoles ranged from 1.8 percent to 5.2 percent. Copilots in instrument flight conditions spent the greatest proportion of their time reaching, and pilots in visual flight conditions spent the least. Despite limitation to this brief retrospective simulator study, these results will be useful in estimating the risk of extremity injuries related to helicopter airbag deployment.

DTIC

*Air Bag Restraint Devices; Military Helicopters; Aircraft Pilots; Injuries*

20000013507 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

**Measurement Accuracy and Precision Assessment of an Image-Based Clothing and Equipment Sizing System**

Meunier, P.; Yin, S.; Jul. 1999; 18p; In English

Report No.(s): AD-A368307; DCIEM-TR-1999-070; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In spite of highly standardized protocols designed to maximize the degree of repeatability and accuracy, traditional anthropometric data are not as reliable as they appear. Many factors come into play during the physical measurement of human subjects, resulting in numerous possible sources of error. Researchers have found the magnitude of these errors to be such that, even if measured by highly trained observers, comparison of two populations may be meaningless. Computerized image based systems can overcome some of the problems of traditional anthropometry, such as error due to instrument alignment, the pressure exerted on soft tissue by the various measurement instruments, or even transcription errors. However, all sources of error have not been eliminated. In image based systems, the sources of error take the form of perspective distortion, camera resolution, and inadequacy of the mathematical models used to estimate circumference measurements. The accuracy of measurements made by an image based clothing and equipment sizing system was estimated using a database of 349 subjects (male and female) who were also measured traditionally. The precision, or repeatability, of this system was estimated through repeated measurements of both a plastic mannequin and a human. Although the image based system did not exhibit systematic bias in the results, the standard deviations were somewhat smaller for some dimensions than those obtained by manual measurement. The repeatability results were comparable to those obtained by highly trained anthropometrists, as reported in recent large scale surveys. The reliability of the measurements needed for clothing, i.e. the proportion of error of measurement to biological variability, was greater than 99% in all cases.

DTIC

*Computer Techniques; Anthropometry; Image Analysis; Human Beings; Clothing*

20000013781 National Inst. for Occupational Safety and Health, Pittsburgh Research Lab., Pittsburgh, PA USA

**Performance Comparison of Rescue Breathing Apparatus**

Kyriazi, Nicholas, National Inst. for Occupational Safety and Health, USA; Oct. 1999; ISSN 1066-5552; 42p; In English

Report No.(s): PB2000-101409; NIOSH-RI-9650; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A performance comparison of 14 rescue breathing apparatus was undertaken as an assessment of past and present worldwide technology. Rescue breathing apparatus are self-contained, close-circuit breathing apparatus used for entry into areas having atmospheres that are immediately dangerous to life and health. Apparatus tested were the Biomarine BioPak 45, 60, and 240; the Draeger BG4 and BG-174A; the Litton LITPAC II; the MSA Custo, 4500 II Air Mask, Chemox, and McCaa; the Sabre Selected Elevated Flow Apparatus (SEFA); the Scott Rescue-Pak; the Siebe Gorman Aerorlox and Proto Ten; and the Survivair LP-120. Physiological parameters monitored during the testing were average inhaled CO<sub>2</sub> and O<sub>2</sub>, minimum inhaled CO<sub>2</sub>, inhaled wet- and dry-bulb temperatures, and peak inhalation and exhalation breathing pressures. The metabolic demand on the apparatus was 1.35 L O<sub>2</sub>/min, the first beginning 10 min into the test and the second beginning 10 min before the end of the rated duration of the apparatus. Results presented include apparatus service life and test-averages of monitored physiological parameters. Schematic drawings and photographs of the apparatus are also included.

NTIS

*Rescue Operations; Breathing Apparatus; Performance Tests; Respiration*

20000013784 Georgia Tech Research Inst., Electronic Systems Lab., Atlanta, GA USA

**Preliminary Human Factors Guidelines for Traffic Management Centers**

Kelly, Michael J., Georgia Tech Research Inst., USA; Jul. 1999; 486p; In English

Contract(s)/Grant(s): DTFH61-92-C-00094

Report No.(s): PB2000-100590; No Copyright; Avail: CASI; A04, Microfiche; A21, Hardcopy

This document provides human factors guidance for designers, owners, operators, and planners engaged in the development and operation of traffic management centers. Specific guidance addresses several dimensions of the work environment that can affect operator and system performance. These dimensions include the operator's work space, the equipment that operators use, and the design of their jobs. Additional guidance is provided for the user-centered design process. Supporting this guidance are several sections on operator capabilities. Several chapters address equipment design and selection. These include the user-computer interface, controls, displays, and job aids. The chapter on job design addresses shift work, team work, simultaneous tasks and workload, and the role of operators designing jobs. This document is intended for application in planning new TMC's and for planning modifications to existing TMC's.

NTIS

*Human Factors Engineering; Traffic; Management Systems; Human-Computer Interface*

20000013996 Army Research Inst. of Environmental Medicine, Natick, MA USA

**Lifting Ability of Army Men and Women in Relation to Occupational Demands**

Sharp, Marilyn A., Army Research Inst. of Environmental Medicine, USA; Knapik, Joseph J., Army Center for Health Promotion and Preventive Medicine (Provisional), USA; Hauret, Keith, Moncrief Army Community Hospital, USA; Frykman, Peter, Army Research Inst. of Environmental Medicine, USA; Patton, John F., Army Research Inst. of Environmental Medicine, USA; Proceedings of the Human Factors and Ergonomics Society 43rd Meeting; 1999, pp. 718-722; In English; 43rd, 1999, Unknown; Sponsored by Human Factors and Ergonomics Society, USA

Report No.(s): AD-A369185; M99-19; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

The primary purpose of this study was to examine the relationship between the lifting strength of soldiers entering the Army and the physical demands of their job. The muscle strength and body composition of 169 male and 153 female recruits were measured prior to basic training. Each soldier's lifting capacity was compared to the lifting standards of their assigned job. Nearly all soldiers were able to meet the standard for frequent lifting; however, 56% and 77% of women could not meet the standard for occasional lifting in the heavy (45.4 kg) and very heavy (>45.4 kg) physical demand category, respectively.

Author

*Muscular Strength; Muscles*

20000014086 Army Aeromedical Research Lab., Fort Rucker, AL USA

**U.S. Army Female Aviator Anthropometric, Clothing, and Cockpit Compatibility Study: Demography and Anthropometry of the Study Cohort *Final Report***

Gordon, Claire C.; Licina, Joseph R.; Nov. 1999; 35p; In English

Contract(s)/Grant(s): 30162787A878; Proj-PE62787A

Report No.(s): AD-A371606; USAARL-2000-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Historically, aircraft design standards have been developed utilizing the 5th to the 95th percentile male. The current U.S. Army aviator population includes many females, who are compelled to operate aircraft that may be ill-fitting and consequently potentially unsafe. This comprehensive research program examined the female-machine match across a variety of Army aircraft

and clothing ensembles. This cohort of female aviators is the largest of its kind using actual female pilots instead of general military females. The demographic characteristics of the 78 volunteers who participated in this study are comparable to other data on the female pilot population as a whole, making the group an excellent sample for studies of cockpit compatibility. The present report addresses the demography and anthropometry of the study cohort. Other reports in the series will address the various clothing and aircraft variables.

DTIC

*Cockpits; Demography; Anthropometry*

20000014087 Army Aeromedical Research Lab., Fort Rucker, AL USA

*Preliminary Design of an Image Quality Tester For Helmet-Mounted Displays Final Report*

Hsieh, Sheng-Jen; Rash, Clarence E.; Harding, Thomas H.; Beasley, Howard H.; Nov. 1999; 50p; In English

Contract(s)/Grant(s): 30162787A879; Proj-PE62787A

Report No.(s): AD-A371607; USAARL-2000-08; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Helmet-mounted displays (HMDs) provide essential pilotage and fire control imagery information for pilots. However, image quality testers for HMD field performance validation do not currently exist. This research employed techniques from imaging analysis and interpretation, and computer-aided design/computer-aided manufacturing (CAD/CAM) to investigate a preliminary design for a portable HMD image tester. For this study, a charged couple device (CCD) camera and lens were selected. Hardware characteristics such as viewing angles in horizontal and vertical positions, dynamic working range at day and night, pixel resolution, focal length, and aperture ratio were evaluated with regard to HMD functionality. Experiments to evaluate camera sensitivity and test pattern merits were conducted using a programmable micro positioning system, CCD camera, optical fixtures and benches. Next, the relative ratio among features within the image profile was established and an ideal image profile and evaluation criteria were established based on the experimental results. Third, image processing algorithms and techniques, such as edge detection, were developed and applied in test pattern feature

DTIC

*Computer Programming; Helmet Mounted Displays; Computer Aided Design*

20000014108 Dayton Univ. Research Inst., Research Inst., OH USA

*A Comparison of Virtual and Live Human Standing Reach Final Report, Apr. 1997-Oct. 1998*

Nemeth, Kristie J.; Ianni, John D.; Wampler, Jeffrey L.; Oct. 1998; 26p; In English

Contract(s)/Grant(s): SPO900-94-D-0001; Proj-2940

Report No.(s): AD-A371580; AFRL-HE-WP-TR-1999-0227; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project investigates the ability of virtual human models to simulate human task performance. A variety of reaching tasks were performed by human subjects and their corresponding virtual human using Transom Jack Software. Transom Jack was able to accurately simulate grasping behaviors for approximately 75% of the trials. The most accurate levels were found at waist and acromion (shoulder) heights. There were significant underestimations for reaches at stature (head) height and significant underestimations for reaches at knee height. Conversely, an overestimation of reach can have more serious implications. In nearly half of the trials at knee height, Transom Jack's simulation outreached the human subjects. Nonetheless, virtual humans provide valuable information in many situations and the technology is rapidly improving.

DTIC

*Computer Aided Design; Human Beings; Height*

20000019594 Specialized Analysis Engineering, Inc., Franklin, TN USA

*A Highly Damped, High-Strength, Puncture-Resistant Fabric for Multi-Threat Protective Uniforms, Phase I Final Report, 5 May - 4 Dec. 1998*

Paine, Jeffrey S.; Tretiakova, Irina V.; Aug. 1999; 56p; In English

Contract(s)/Grant(s): DAAN02-98-P-8547

Report No.(s): AD-A371636; NITIOSD-120498-RP; NATICK-TR-99/040; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Phase I project was very successful in demonstrating the feasibility of using a superelastic Nitinol shape memory alloy to improve cut, tear, and puncture resistance of military Battle Dress Uniform (BDU) fabric. The Nitinol reinforcement increased cut-resistance by 20 times and tear resistance by 2.5 times the values for current BDU fabric. Cotton/Nylon plain weave fabrics were fabricated in small lots with excellent quality for testing. Various reinforcements were added to demonstrate enhanced mechanical performance. The force-displacement tensile curves from the Modified Grab Test results show that the addition of Nitinol to the fabric doesn't significantly alter flexibility level. The fabrics experienced a 50 to 60 percent increase in breaking

strength over the plain fabric with the 5 and 10 Nitinol fibers per inch. Calculations of areal density do not show significant difference between reinforced fabric and plain fabric. Fabric does not kink unless subjected to very severe loads. Wrinkles cannot develop because the shape memory effect returns the Nitinol reinforcement to original shape. Nitinol provides an electrical conduit in the uniform that minimizes shock and static discharge. The Phase I effort has positively demonstrated the feasibility of gaining improved protection in textiles without sacrificing fabric flexibility.

DTIC

*Fabrics; Piercing; Protective Clothing; Damping*

20000019632 Monterey Technologies, Inc., Los Gatos, CA USA

*Crew Fatigue and Performance on U.S. Coast Guard Cutters Final Report*

Miller, James C., Monterey Technologies, Inc., USA; October 1998; 150p; In English

Contract(s)/Grant(s): DTRS-57-93-D-0095; Proj. 3302.04.02

Report No.(s): AD-A366708; CG-D-10-99; R&DC-31-99; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

This report describes an analysis of crew workload and fatigue on Coast Guard cutters. Descriptive measures were obtained on five cutters of three types under normal operations. Evidence of mild fatigue, specifically daytime sleepiness and a degradation of vigilance performance, was observed in many crew members. This study documented levels of workload, performance, and fatigue found in normal, daily Coast Guard cutter operations. Principles of industrial chronohygiene were considered in light of the analysis of crew member sleep patterns, circadian rhythms, and watch schedules. This analysis led to recommendations for watch schedule alternatives that may reduce the probability of crew daytime sleepiness and vigilance performance degradation.

Author

*Crews; Fatigue (Biology); Human Factors Engineering; Ships; Human Performance*

## 55

### EXO BIOLOGY

*Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.*

20000012440 Nagoya Univ., Nagoya Japan

*Proceedings of the International Symposium on Micromechatronics and Human Science*

Nov. 29, 1999; 292p; In English, 23-26 Nov. 1999, Nagoya, Japan

Contract(s)/Grant(s): F62562-99-M-9216

Report No.(s): AD-A371152; AOARD-CSP-991009; No Copyright; Avail: Defense Technical Information Center (DTIC), Hardcopy

The conference proceeding includes topics in the following areas: (1) Micro/nano manipulation and Control, (2) Microfabrication, Material, and Property 1, (3) Microrobot, (4) Microfabrication, Material, and Property 2, (5) Microcomponents and Microdevices 1, (6) Microcomponents and Microdevices 2, and (7) Measurement and System.

DTIC

*Conferences; Microminiaturization*

# Subject Term Index

## A

ABDOMEN, 16  
ABNORMALITIES, 3  
ACCELERATION (PHYSICS), 3  
ADAPTIVE CONTROL, 2, 5  
ADRENERGICS, 2  
AEROSPACE MEDICINE, 6, 7, 8, 10  
AIR CONDITIONING EQUIPMENT, 13  
AIR TRAFFIC CONTROL, 16  
AIRCRAFT ACCIDENT INVESTIGATION, 8  
AIRLINE OPERATIONS, 12  
ALERTNESS, 4  
ANOMALIES, 3  
ANTIGRAVITY, 16  
ANTIHISTAMINICS, 8  
ARMED FORCES (UNITED STATES), 14  
ASCORBIC ACID, 9  
AUTONOMIC NERVOUS SYSTEM, 5  
AUTONOMY, 2

## B

BIOCHEMISTRY, 6  
BIODYNAMICS, 10  
BIOMEDICAL DATA, 10  
BIONICS, 10  
BLADDER, 16  
BLOOD FLOW, 7  
BLOOD VESSELS, 3  
BLOOD VOLUME, 3  
BONE DEMINERALIZATION, 6  
BONES, 5  
BRAIN CIRCULATION, 7

## C

C-135 AIRCRAFT, 11  
CARDIOGRAPHY, 8  
CARDIOVASCULAR SYSTEM, 3, 5, 10  
CAROTENE, 9  
CELL MEMBRANES (BIOLOGY), 1  
CELLS (BIOLOGY), 1, 2, 6  
CHEMORECEPTORS, 2  
COASTAL WATER, 3  
COMPUTER ANIMATION, 11  
COMPUTERIZED SIMULATION, 4, 10, 11

CONFIGURATION MANAGEMENT, 15  
CONSUMABLES (SPACECRAFT), 13  
CULTURE TECHNIQUES, 2

## D

DATA PROCESSING TERMINALS, 12  
DEATH, 8  
DEFOCUSING, 4  
DEFORMATION, 1  
DEOXYRIBONUCLEIC ACID, 1, 2, 9  
DESIGN ANALYSIS, 13  
DISPLAY DEVICES, 12  
DIVING (UNDERWATER), 12  
DOGS, 8

## E

EDUCATION, 8  
ELBOW (ANATOMY), 5  
ELECTRIC FIELDS, 6  
ELECTROCARDIOGRAPHY, 8  
ELECTROENCEPHALOGRAPHY, 10  
ELECTROPHORESIS, 1  
ENVIRONMENT EFFECTS, 12  
ENZYME ACTIVITY, 3  
ERROR ANALYSIS, 16  
EVALUATION, 6  
EVOKED RESPONSE (PSYCHOPHYSIOLOGY), 10  
EXO BIOLOGY, 17  
EXTRAVEHICULAR ACTIVITY, 13

## F

FABRICS, 14  
FATIGUE (BIOLOGY), 4, 6  
FIRE FIGHTING, 13  
FLAMMABILITY, 14  
FLIGHT CLOTHING, 14  
FORMATION, 3  
FRACTURES (MATERIALS), 6  
FRACTURING, 6

## G

GENE EXPRESSION, 2  
GENETICS, 6

GEOCHEMISTRY, 3  
GLARE, 12

## H

HEAD DOWN TILT, 7  
HEAD MOVEMENT, 15  
HEALING, 6  
HEART, 5, 8  
HELMET MOUNTED DISPLAYS, 15  
HUMAN BODY, 13  
HUMAN FACTORS ENGINEERING, 4, 8, 10, 11, 15, 16  
HUMAN PERFORMANCE, 10  
HUMAN-COMPUTER INTERFACE, 15  
HYDROSTATIC PRESSURE, 10  
HYPERBARIC CHAMBERS, 12  
HYPOTHERMIA, 8  
HYPOTHESES, 14

## I

IMAGE ANALYSIS, 3, 4  
IMAGE PROCESSING, 4  
IMAGE RECONSTRUCTION, 4  
IMAGING TECHNIQUES, 4  
IMMOBILIZATION, 6  
INCREASING, 11  
INFORMATION RETRIEVAL, 5  
INTERRUPTION, 12  
ISOTOPES, 17

## L

LAMINATES, 14  
LASER SPECTROMETERS, 17  
LAUNCHING, 3  
LIFE SUPPORT SYSTEMS, 13

## M

MAN MACHINE SYSTEMS, 16  
MANAGEMENT PLANNING, 15  
MANNED MARS MISSIONS, 13  
MANNED SPACE FLIGHT, 13  
MARS MISSIONS, 13  
MASKS, 14  
MATHEMATICAL MODELS, 10  
MICROGRAVITY, 3

MILITARY OPERATIONS, 14  
MODELS, 5  
MOTION SIMULATION, 15  
MULTIPLEXING, 1  
MULTIVARIATE STATISTICAL ANALYSIS, 5  
MUSCLES, 2, 6  
MUSCULAR STRENGTH, 4  
MUSCULOSKELETAL SYSTEM, 5, 6

## N

NAVY, 12  
NERVES, 5  
NUMERICAL CONTROL, 15

## O

OCULOMOTOR NERVES, 10  
ON-LINE SYSTEMS, 1  
OPERATOR PERFORMANCE, 10  
ORTHOPEDICS, 6  
OUTPUT, 4  
OXYGEN, 9

## P

PHASE MODULATION, 4  
PHOSPHATES, 3  
PHOSPHORUS, 3  
PHYSICAL EXERCISE, 8  
PHYSIOLOGICAL ACCELERATION, 6  
PHYSIOLOGY, 8  
PHYTOPLANKTON, 3  
PILOT PERFORMANCE, 8  
POTABLE WATER, 13  
PREVENTION, 8  
PROTECTION, 14  
PROTECTIVE CLOTHING, 13, 14

## Q

QUALITY CONTROL, 14

## R

RATES (PER TIME), 11  
READING, 11  
REGENERATION (ENGINEERING), 13  
REPRODUCTION (BIOLOGY), 2  
RESEARCH, 17  
RISK, 8  
ROBOT ARMS, 15

## S

SAMPLES, 1  
SEMICONDUCTOR LASERS, 17  
SENSORY FEEDBACK, 5  
SEQUENCING, 1  
SIMULATORS, 5  
SPACE SUITS, 13  
SPECIMENS, 4  
STRESS (PHYSIOLOGY), 6  
STRETCHERS, 12  
SWINE, 8  
SYMPATHETIC NERVOUS SYSTEM, 2  
SYSTEMS INTEGRATION, 15

## T

TASK COMPLEXITY, 14  
TECHNOLOGY ASSESSMENT, 6  
TEMPERATURE CONTROL, 13  
TEMPERATURE EFFECTS, 13  
TEMPERATURE MEASUREMENT, 13  
TEXTS, 11  
TIBIA, 6  
TIME MEASUREMENT, 11  
TOCOPHEROL, 9  
TRUCKS, 4  
TUNABLE LASERS, 17

## V

VIABILITY, 1  
VIDEO DATA, 12  
VISUAL PERCEPTION, 10

## W

WEIGHTLESSNESS, 6, 10  
WORDS (LANGUAGE), 11

# Personal Author Index

## A

Ahlstrom, Vicki, 16  
Ando, Hideki, 6  
Ando, Toshiyuki, 4  
Askew, Eldon W., 9  
Aven, A., 4

## B

Bergsten, E., 15  
Boda, K., 3  
Boyce, Lisa A., 14  
Bridge, Kristin Y., 2  
Briggs, G., 8

## C

Canfield, Dennis V., 8  
Chao, Wei-Hsun, 9  
Chaturvedi, Arvind K., 8  
Chiba, Yasuhiro, 7  
Cohen, Kathryn S., 14  
Cranston, Robert L., 16  
Crawford, Sekou S., 12

## D

Daanen, H. A. M., 7  
Dadasheva, O. A., 3  
Dischinger, H. Charles, Jr., 11  
Dubrovin, L. C., 3

## E

Egglestone, G. T., 13  
Eiken, O., 15

## G

Glenn, Christopher, 13  
Gould, R. B., 14  
Groenkvist, M., 15  
Guryeva, T. S., 3  
Gustafsson, P., 15

## H

Hamilton, George S., 11  
Henry, M. K., 3  
Herderick, E., 8  
Hirayanagi, Kaname, 6

## J

Jahns, G. C., 3

## K

Kakimoto, Yukiko, 7  
Kauffman, Stuart, 1  
Koga, Kazuo, 6  
Koike, Yu, 7  
Krueger, Gerald P., 4

## L

Lagel, K. E., 3  
LaJonchere, Clara M., 10  
Latorella, Kara A., 12  
Latson, G. W., 11  
Lawson, J. R., 13  
Lelkes, P. I., 3  
Lelkes, Peter I., 2

## M

MacMillan, Jean, 16  
Mano, Tadaaki, 6  
Marcus, Robert, 6  
McGowan, Adam L., 4  
McNamara, Danielle S., 11  
Miura, Naoto, 5  
Mori, Sigeo, 6

## N

Nakajima, Hidekazu, 10  
Nakatani, Hironori, 5  
Nakayama, T., 8  
Nozawa, Tsuneyuki, 5

## O

Oernhagen, H., 15  
Ohira, Yoshinobu, 6  
ONeill, Timothy R., 4

## P

Packingham, Kevin D., 10  
Padmos, P., 15  
Pew, Richard W., 16  
Philipp, B. L., 14  
Piert, S. J., 3  
Powers, J., 8

## R

Reading, James E., 9  
Roberts, Donald E., 9  
Robinson, D. J., 13

Rohrbaugh, John W., 10  
Ruttenberg, Kathleen C., 3

## S

Sabo, V., 3  
Samet, M. M., 3  
Sandstroem, L., 15  
Satake, Hiroataka, 6  
Sato, Makoto, 4  
Sauke, Todd B., 16  
Sharp, M. Keith, 9  
Shimizu, Ryuichi, 4  
Sirevaag, Erik J., 10  
Smith, Charles K., II, 2  
Smith, E., 8  
Soper, John W., 8  
Stern, John A., 10  
Sudoh, Masamichi, 7  
Sugenoya, Junichi, 6  
Sychev, B. R., 3

## T

Takai, Yoshizo, 4  
Takamatsu, Hiroshi, 1  
Tan, H., 1  
Tanaka, Akira, 5  
Taya, Yasushi, 7  
Tenney, Yvette J., 16  
Turner, R. T., 6  
Twilley, W. H., 13

## U

Unsworth, B. R., 3

## V

VanHemel, Susan B., 4  
Vedeniapin, Andrei B., 10

## W

Wenemark, R., 4  
Wood, Steven M., 9  
Wu, Hsin-I., 11

## Y

Yamamoto, Isao, 7  
Young, Ronald B., 2

## Z

Zinszer, M. A., 11

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