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August 19, 1996

# AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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# Introduction

This issue of *Aerospace Medicine and Biology, A Continuing Bibliography with Indexes* (NASA SP-7011) lists 19 reports, articles, and other documents recently announced in the NASA STI Database.

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

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# Appendix

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

# Typical Report Citation and Abstract

ACCESSION NUMBER ↓

DOCUMENT ID NUMBER → **19960021053;** 96N24540 NASA Langley Research Center, Hampton, VA USA. ← CORPORATE SOURCE

TITLE → **An Extended Compact Tension Specimen for Fatigue Crack Propagation and Fracture**

AUTHORS → Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; ← AUTHORS' AFFILIATION

PUBLICATION DATE → Mar. 1996, pp. 16; In English

CONTRACTS/GRANTS → Contract(s)/Grant(s): RTOP 538–02–10–01

REPORT NO.(S) → Report No.(s): NASA–TM–110243; NAS 1.15:110243; No Copyright; Avail: CASI A03, Hardcopy; A01, Microfiche ← AVAILABILITY AND PRICE CODE

ABSTRACT → An extended compact tension specimen, EC(T) has been developed for fatigue and fracture testing. Documented herein are stress-intensity factor and compliance expressions for the EC(T) specimen.

ABSTRACT AUTHOR → Author

SUBJECT TERMS → *Crack Propagation; Stress Intensity Factors; Fatigue (Materials)*

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 420)*

AUGUST 19, 1996

## 51
## LIFE SCIENCES (GENERAL)

**19960025801**; 96N27689 Argonne National Lab., IL USA
**Characterization of photosynthetic supramolecular assemblies using small angle neutron scattering**
Tiede, D. M., Argonne National Lab., USA; Marone, P., Argonne National Lab., USA; Wagner, A. M., Argonne National Lab., USA; Thiyagarajan, P., Argonne National Lab., USA; 1995, pp. 10p; In English; 10; International Photosynthesis Congress, 20-25 Aug. 1995, Montpellier, France
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/CP-86353; CONF-9508202-5; DE96-005233; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are using small angle neutron scattering (SANS) to resolve structural features of supramolecular assemblies of photosynthetic proteins in liquid and frozen solutions. SANS resolves the size, shape, and structural homogeneity of macromolecular assemblies in samples identical to those used for spectroscopic assays of photosynthetic function. Likely molecular structures of the supramolecular assemblies can be identified by comparing experimental scattering data with scattering profiles calculated for model supramolecular assemblies built from crystal structures of the individual proteins. SANS studies of the Rhodobacter sphaeroides reaction center, RC, presented here, show that the detergent solubilized RC exists in a variety of monomeric and aggregation states. The distribution between monomer and aggregate was found to depend strongly upon detergent, temperature and nature of additives, such as ethylene glycol used for low temperature spectroscopy and polyethylene glycol used for crystallization. Likely aggregate structures are being identified by fitting the experimental scattering profiles with those calculated for model aggregates built-up using the RC crystal structure. This work establishes the foundation for using SANS to identify intermediates in the RC crystallization pathways, and for determining likely structures of complexes formed between the RC and its physiological reaction partners, cytochrome c, and the LHI antenna complex.
DOE
*Monomers; Neutron Scattering; Ethylene Compounds; Molecular Structure; Aggregates; Additives; Detergents; Low Temperature*

**19960026046**; 96N27804 Department of the Navy, Washington, DC USA
**Freeze Dried Platelets**
Spargo, Barry J., Inventor, Department of the Navy, USA; Emler, Richard G., Inventor, Department of the Navy, USA; Groel, Thomas R., Inventor, Department of the Navy, USA; Oct. 20, 1995, pp. 22p; In English
Patent Info.: US-Patent-Appl-SN-546464
Report No.(s): AD-D017793; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A process and medium are disclosed for the lyophilization of platelets. During lyophilization, carbohydrate-load platelets are supercooled while suspended in a buffer solution including a biocompatible polymer that serves to preserve the structure of the platelets. The supercooled platelets are then frozen at a temperature below the glass transition temperature of the suspension. A vacuum is placed on the frozen suspension to remove most of the water therefrom. Then, the temperature of the platelets is increased to the supercooled temperature while the vacuum is maintained. After being sealed under vacuum, the lyophilized platelets may be reconstituted to form viable, transfusable platelets. The reconstituted platelets have a high aggregation index, retain normal agglutination and degranulation capability, and are able to participate in clot formation.
DTIC
*Freeze Drying; Platelets; Blood Coagulation; Glass Transition Temperature; Clotting; Supercooling*

**19960026076**; 96N27823 Bionetics Corp., Cocoa Beach, FL USA
**Dynamics of microorganism populations in recirculating nutrient solutions**
Strayer, R. F., Bionetics Corp., USA; Jan. 1994; ISSN 0273-1177, pp. 10p; In English
Report No.(s): NASA-TM-111241; NAS 1.15:111241; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This overview covers the basic microbial ecology of recirculating hydroponic solutions. Examples from NASA and Soviet CELSS tests and the commercial hydroponic industry will be used. The sources of microorganisms in nutrient solutions include air, water, seeds, plant containers and plumbing, biological vectors, and personnel. Microbial fates

include growth, death, and emigration. Important microbial habitats within nutrient delivery systems are root surfaces, hardware surfaces (biofilms), and solution suspension. Numbers of bacteria on root surfaces usually exceed those from the other habitats by several orders of magnitude. Gram negative bacteria dominate the microflora with fungal counts usually much lower. Trends typically show a decrease in counts with increasing time unless stressed plants increase root exudates. Important microbial activities include carbon mineralization and nitrogen transformations. Important detrimental interactions include competition with plants, and human and plant pathogenesis.
Author
*Hydroponics; Microorganisms; Closed Ecological Systems; Pathogenesis; Recirculative Fluid Flow; Nutrients; Solutions; Ecology*

**19960026152**; 96N27880 Louisville Univ., Dep. of Physiology and Biophysics., KY USA
**Alterations in Skeletal Muscle Microcirculation of Head-Down Tilted Rats**
Musacchia, X. J., Missouri Univ., USA; Stepke, Bernhard, Missouri Univ., USA; Fleming, John T., Missouri Univ., USA; Joshua, Irving G., Missouri Univ., USA; [1992], pp. 26p; In English
Contract(s)/Grant(s): NAG2-386
Report No.(s): NASA-CR-201392; NAS 1.26:201392; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study we assessed the function of microscopic blood vessels in skeletal muscle (cremaster muscle) for alterations which may contribute to the observed elevation of blood pressure associated with head-down tilted whole body suspension (HDT/WBS), a model of weightlessness. Arteriolar baseline diameters, vasoconstrictor responses to norepinephrine (NE) and vasodilation to nitroprusside (NP) were assessed in control rats, rats suspended for 7 or 14 day HDT/WBS rats, and rats allowed to recover for 1 day after 7 days HDT/WBS. Neither baseline diameters nor ability to dilate were influenced by HDT/WBS. Maximum vasoconstriction to norepinephrine was significantly greater in arterioles of hypertensive 14 day HDT/WBS rats. This first study of the intact microvasculature in skeletal muscle indicates that an elevated contractility of arterioles to norepinephrine in suspended rats, and suggests an elevated peripheral resistance in striated muscle may contribute to the increase in blood pressures among animals subjected to HDT/WBS.
Author
*Blood Vessels; Physiological Responses; Vasoconstriction; Norepinephrine; Head Down Tilt; Blood Circulation; Weightlessness; Blood Pressure*

**19960026627**; 96N28196 Baylor Coll. of Medicine, Houston, TX USA
**Cloning Human Chromosome 17 Genes: Candidate Genes for BRCA1** ***Annual Report, 15 Sep. 1994 - 14 Sep. 1995***
Lee, Cheng-Chi, Baylor Coll. of Medicine, USA; Oct. 1995, pp. 16p; In English
Contract(s)/Grant(s): DAMD17-94-J-4484
Report No.(s): AD-A302601; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our research interest is focused on the development of new strategies to identify genes from chromosome 17. The isolation of genes transcribed from chromosome 17 will provide candidates for the proposed sporadic breast and ovarian cancer genes. We have recently reported a method for the isolation of chromosome specific cDNAs using high density arrayed cDNA and chromosome specific cosmid libraries. The ability to isolate genes in a chromosome specific manner provides simultaneous identification of the expressed sequence and a chromosomal location. This new technology identifies expressed sequences by reciprocal probing of arrayed cDNA libraries and a chromosome specific cosmid library. We have used these resources to identify 1794 clones from the Los Alamos chromosome 17 cosmid library using probes generated from a placental cDNA library. So far, we have isolated and characterized 42 cDNAs to chromosome 17. Several of these cDNAs mapped to the region 17p13, while 14 other cDNAs mapped to the region of 17q12-22. Recent studies have demonstrated that in some sporadic breast cancer there are loss of heterozygosity (LOH) in these regions of human chromosome 17.
DTIC
*Mammary Glands; Cancer; Chromosomes; Deoxyribonucleic Acid*

**19960026709**; 96N28271 Atomic Energy Commission, Dept. of Radiation Protection and Nuclear Safety., Damascus, Syrian Arab Republic
**Solar ultraviolet radiation in Syria measurements and relationship with skin cancer incidence**
Othman, I., Atomic Energy Commission, Syrian Arab Republic; Baydon, S. A., Atomic Energy Commission, Syrian Arab Republic; Dawood, S., Damascus Univ., Syrian Arab Republic; Nov. 1994, pp. 66p; In Arabic
Report No.(s): AECS-P-B/FRSR-89; DE96-610609; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Seasonal variations of solar UVB (285-320) and UVA (320-400) were measured in three sites in Syria (33-37 N sup O) for two years: 1992-1993. UVB measurements were performed using polysulphone films and Robertson-Berger meter, while UVA measurements were done by NVA intensity meter. Two sets of measurements were carried out : maximal daily doses three times a week (every other day), and diurnal variations from sun-rise to sun-set every two hours twice a month (every fortnight). The biological consequences of ultraviolet radiation with reference to some epidemiological

data of skin cancer incidence in Syria since 1980 were discussed.
DOE
*Ultraviolet Radiation; Solar Radiation; Cancer; Radiation Effects*

## 52
## AEROSPACE MEDICINE

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

**19960025638**; 96N27642 Victoria Univ., British Columbia Canada
**Analysis of +G(sub z) acceleration induced stresses in the human ventricle myocardium**
Moore, James Ernest, Victoria Univ., Canada; Jan. 01, 1994, pp. 128p; In English; ISBN-0-315-93507-3; No Copyright; Avail: Univ. Microfilms Order No. DANN93507, Hardcopy, Microfiche

It is well known that physiological problems occur when pilots are subjected to moderate-to-high +G(sub z) accelerations. The goal of this research is to develop a quantitative model that provides additional insight into the adverse effects of +G(sub z) accelerations on a pilot's cardiovascular system The method of investigation is in contrast to previous studies, which have mainly relied on experimental techniques. This work focuses on the development of a three-dimensional finite element model to analyze +G(sub z) induced stresses in the human left and right ventricles. The computational model is based on non-linear continuum theory, where the effects of finite deformation, irregular shape of the heart, and (nearly) incompressible behavior of myocardium tissue are taken into account. The finite element formulation is developed using the Galerkin weighted residual method with a penalty treatment of the incompressibility condition. In this study, an exponential type strain energy function is used to model the cardiac tissue. This technique provides a new perspective for the mechanical study of +G(sub z) acceleration on the human heart. Results presented demonstrate the ability of the finite element model to provide quantitative data on the effects of gravitational loading on the cardiovascular system. The analysis predicts gross distortion and stress data for the human heart under sustained exposure to inertia loading up to +5 G(sub z).
Dissert. Abstr.
*Finite Element Method; Prediction Analysis Techniques; Myocardium; Acceleration Stresses (Physiology); Physiological Acceleration; Aerospace Medicine; Body Kinematics; High Acceleration; Galerkin Method; Gravitational Physiology*

**19960025662**; 96N27658 California Univ., Dept. of Pharmacology., Irvine, CA USA
**Mechanisms of Microgravity Effect on Vascular Function *Progress Report, Year 1, 1995***
Purdy, Ralph E., California Univ., USA; Jan. 1995, pp. 20p; In English
Contract(s)/Grant(s): NAGw-4415
Report No.(s): NASA-CR-200573; NAS 1.26:200573; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of the project is to characterize the effects of simulated microgravity on vascular function. Microgravity is simulated using the hindlimb unweighted (HU) rat, and the following vessels are removed from HU and paired control rats for in vitro analysis: abdominal aorta, carotid and femoral arteries, jugular and femoral veins. These vessels are cut into 3 mm long rings and mounted in tissue baths for the measurement of either isometric contraction, or relaxation of pre- contracted vessels. The isolated mesenteric vascular bed is perfused for the measurement of changes in perfusion pressure as an index of arteriolar constriction or dilation. This report presents, in addition to the statement of the overall goal of the project, a summary list of the specific hypotheses to be tested. These are followed by sections on results, conclusions, significance and plans for the next year. Derived from text
*Cardiovascular System; Microgravity; Rats; Physiological Effects; Gravitational Effects; Weightlessness*

**19960025725**; 96N27660 Civil Aeromedical Inst., Oklahoma City,OK USA
**The Analysis of Benzodiazepines in Forensic Urine Samples *Final Report***
Kupiec, Thomas C., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; White, Vicky L., Civil Aeromedical Inst., USA; Apr. 1996, pp. 16p; In English
Report No.(s): DOT/FAA/AM-96/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The FAA Toxicology and Accident Research Laboratory reports the presence of any drug detected at therapeutic or subtherapeutic levels and the medical condition for which the drug may have been used. Specimens from the pilot of a fatal aviation accident in 1992 were suspected of containing fluoxetine and clonazepam. Initial screening tests using fluorescence polarization immunoassay of a urine specimen revealed 86 ng/mi of a benzodiazepine. Blood from this case was screened using radioimmunoassay and a benzodiazepine was detected at a level in excess of 200 ng/ml. No benzodiazepine was detected in the urine specimen when it was initially tested using HPLC with no hydrolysis of the specimen. Temazepam was eventually identified in urine by HPLC and Mass Spectroscopy, after enzyme hydrolysis of the urine using 0-glucuronidase. The blood was found to contain 44 ng/mi of temazepam, 83 ng/mi of fluoxetine, and 138 ng/ml of norfluoxetine. The liver was found to contain 145 ng/mi of temazepam. No tests were per-

formed on the liver for fluoxetine. The identification of temazepam in urine would have been impossible without the enzyme hydrolysis of the specimen prior to extraction and identification. Benzodiazepines are among the most prescribed drugs and a procedure is needed to assure that these drugs will be detected and identified in urine.
Author
*Urine; Toxicology; Enzymes; Hydrolysis; Benzoic Acid; Pilot Performance; Flight Safety*

**19960026058**; 96N27811 Defence Science and Technology Organisation, Ship Structures and Materials Div., Melbourne, Australia
**Guidelines for Safe Handling of Toxins**
Szilagyi, Maria, Defence Science and Technology Organisation, Australia; Nov. 1995, pp. 16p; In English
Report No.(s): DSTO-TR-0247; AR-009-385; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Toxins are highly toxic chemicals which cause illness through all routes of entry into the body. This technical note has been prepared to ensure that preparation, handling, and disposal of toxins does not constitute a greater occupational hazard than is necessary. It includes hazards that may be encountered and the precautions that should be taken against such hazards.
Author
*Accident Prevention; Waste Disposal; Decontamination; Protective Clothing; Toxic Hazards; Toxins and Antitoxins; Safety Management; Materials Handling*

**19960026349**; 96N28023 Purdue Research Foundation, IN USA
**Electrically Mediated Trauma Repair** ***Annual Report, 22 Aug. 1994 - 21 Aug. 1995***
Borgens, Richard B., Purdue Research Foundation, USA; Sep. 18, 1995, pp. 23p; In English; Original contains color plates
Contract(s)/Grant(s): DAMD17-94-J-4242
Report No.(s): AD-A302493; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As an external application to injured or developing systems, steady voltage gradients can alter the dynamics of such processes in a predictable and polarized way. We have exploited this in ways designed to enhance the regeneration of nervous tissue with small current regulated implantable devices. We have facilitated regeneration of nerve fibers within the lesioned adult mammalian spinal cord following acute application of DC fields. Further tests proved that a recovery of function in a normally permanent sensorimotor defects secondary to severance of the relevant intramedullary spinal cord tracts could be induced. This research employed the cutaneus trunci muscle reflex (CTM) of the adult guinea pig where functioning of skin musculature is dependent on long afferent projections within the ventrolateral spinal cord. Evaluation of skin movement and electrophysiological evaluation of the reflex proved that up to 25% of electrically treated animals recovered reflex functioning while 100% of the sham treated population remained permanently impaired. Further development of devices designed to affect both ascending and descending nerve fiber projections have been tested to be effective in restoring variable levels of functional recovery in clinical cases of naturally produced, and neurologically complete paraplegia in canines. We believe this technique provides a relatively simple medical intervention to recover lost functions following severe traumatic CNS injury.
DTIC
*Central Nervous System; Electrophysiology; Clinical Medicine; Tissues (Biology); Regeneration (Physiology); Electric Potential; Injuries*

## 53
## BEHAVIORAL SCIENCES

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

**19960026242**; 96N27954 Brookhaven National Lab., Dept. of Physics., Upton, NY USA
**Democratic reinforcement: Learning via self-organization**
Stassinopoulos, Dimitris, Florida Atlantic Univ., USA; Bak, Per, Brookhaven National Lab., USA; 1995, pp. 12p; In English; International Conference on Radiation Dose Management, 3-5 Oct. 1995, Windermere, UK
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-62639; CONF-951034-1; DE96-006774; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The problem of learning in the absence of external intelligence is discussed in the context of a simple model. The model consists of a set of randomly connected, or layered integrate-and fire neurons. Inputs to and outputs from the environment are connected randomly to subsets of neurons. The connections between firing neurons are strengthened or weakened according to whether the action is successful or not. The model departs from the traditional gradient-descent based approaches to learning by operating at a highly susceptible 'critical' state, with low activity and sparse connections between firing neurons. Quantitative studies on the performance of our model in a simple association task show that by tuning our system close to this critical state we can obtain dramatic gains in performance.
DOE
*Learning Theory; Neurons; Neural Nets; Artificial Intelligence*

## 54
## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

**19960025805**; 96N27691 Argonne National Lab., Idaho Falls, ID USA

**How the user views visual displays**

Brown-VanHoozer, S. Alenka, Argonne National Lab., USA; 1995, pp. 10p; In English; 39th; Human Factors and Ergonomics Society Meeting, 9-13 Oct. 1995, San Diego, CA, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/IFR/SUMM-85775; CONF-951092-5; DE96-004810; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Most designers are not schooled in the area of human-interaction psychology and therefore tend to rely on the traditional ergonomic aspects of human factors when designing complex human-interactive workstations. Unfortunately, by ignoring the importance of the integration of the user interface at the psychophysiological level, the result can be ineffective use of a system leading to an inherently error- and failure-prone system. Therefore, to minimize failures in a human-interactive system, it is essential that designers understand how each user's processing characteristics affect how the user gathers and processes information. by understanding the significant processing characteristics of the user, designers can implement practical and effective visual displays (or any other type of system) that are more desirable to all users. The material presented in this paper is based on a general study that involved users' perspective views of how visual displays should be designed for effective use. The methodology used was Neuro-Linguistic Programming (NLP), because of its applicability in expanding design choices from the users' 'model of the world.' The findings of the study have provided a beginning in the development of user comfort parameters and visual displays.

DOE

*Display Devices; Human Factors Engineering; Computer Programs; Workstations; Computer Systems Design; Man Machine Systems*

**19960026149**; 96N27877 Iowa State Univ., Dept. of Chemical Engineering., Ames, IA USA

**Space Life-Support Engineering Program *Final Report, 1 Nov. 1993 - 30 Apr. 1995***

Seagrave, Richard C., Principal Investigator, Iowa State Univ., USA; Apr.1995, pp. 80p; In English

Contract(s)/Grant(s): NAG2-885

Report No.(s): NASA-CR-201391; NAS 1.26:201391; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report covers the seventeen months of work performed under an extended one year NASA University Grant awarded to Iowa State University to perform research on topics relating to the development of closed-loop long-term life support systems with the initial principal focus on space water management. In the first phase of the program, investigators from chemistry and chemical engineering with demonstrated expertise in systems analysis, thermodynamics, analytical chemistry and instrumentation, performed research and development in two major related areas; the development of low-cost, accurate, and durable sensors for trace chemical and biological species, and the development of unsteady-state simulation packages for use in the development and optimization of control systems for life support systems. In the second year of the program, emphasis was redirected towards concentrating on the development of dynamic simulation techniques and software and on performing a thermodynamic systems analysis, centered on availability or energy analysis, in an effort to begin optimizing the systems needed for water purification. The third year of the program, the subject of this report, was devoted to the analysis of the water balance for the interaction between humans and the life support system during space flight and exercise, to analysis of the cardiopulmonary systems of humans during space flight, and to analysis of entropy production during operation of the air recovery system during space flight.

Author

*Life Support Systems; Water Management; Space Flight; Cardiovascular System; Pulmonary Circulation; Water Balance; Physiological Responses; Astronaut Performance*

**19960026373**; 96N28046 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

**The Specification of Users and their Roles**

Donati, A. L., Defence and Civil Inst. of Environmental Medicine, Canada; Beevis, David, Defence and Civil Inst. of Environmental Medicine, Canada; Oct. 1995, pp. 22p; In English

Report No.(s): AD-A301856; DCIEM-95-29; Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Although the approach to systems development varies widely, the overall approach to human factors engineering in military system development is usually specified by US MIL-STD-46855. The approach set out in MIL-STD-46855 emphasizes analysis and reflects the traditional waterfall model of systems development, although there is nothing inherent in the standard to prevent an iterative approach. A review of ten Canadian Forces development projects concluded that the application of human factors engineering, was enhanced by the use of a Human Engineering Project Plan based on MIL-STD-46855. A subsequent survey of approaches used to include user requirements in development projects showed large differences in attitude and practice. The survey identified the need for aids to facilitate the inclusion of

users' requirements in the Statements of Requirements. Designers also need to know the context in which their system or equipment will be employed. This is particularly true of personal equipment. Few designers of advanced systems have knowledge of operational conditions and constraints. One development (the Soldier's Day) being undertaken for the Canadian Forces is aimed at providing designers with the context of the roles and tasks that operators perform, as an aid to understanding how equipment will be used.
DTIC
*Human Factors Engineering; Canada; User Requirements*

**19960026477**; 96N28122 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
**Computational Virtual Reality (VR) as a human-computer interface in the operation of telerobotic systems**
Bejczy, Antal K., Jet Propulsion Lab., California Inst. of Tech., USA; Nov. 1995, pp. 39-44; In English; Also announced as 19960026474; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This presentation focuses on the application of computer graphics or 'virtual reality' (VR) techniques as a human-computer interface tool in the operation of telerobotic systems. VR techniques offer very valuable task realization aids for planning, previewing and predicting robotic actions, operator training, and for visual perception of non-visible events like contact forces in robotic tasks. The utility of computer graphics in telerobotic operation can be significantly enhanced by high-fidelity calibration of virtual reality images to actual TV camera images. This calibration will even permit the creation of artificial (synthetic) views of task scenes for which no TV camera views are available.
Author (revised)
*Human-Computer Interface; Virtual Reality; Telerobotics*

**19960026480**; 96N28125 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering., Cambridge, MA USA
**Haptic interfaces: Hardware, software and human performance**
Srinivasan, Mandayam A., Massachusetts Inst. of Tech., USA; Nov. 1995, pp. 104-121; In English; Also announced as 19960026474
Contract(s)/Grant(s): N61339-94-C-0087; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Virtual environments are computer-generated synthetic environments with which a human user can interact to perform a wide variety of perceptual and motor tasks. At present, most of the virtual environment systems engage only the visual and auditory senses, and not the haptic sensorimotor system that conveys the sense of touch and feel of objects in the environment. Computer keyboards, mice, and trackballs constitute relatively simple haptic interfaces. Gloves and exoskeletons that track hand postures have more interaction capabilities and are available in the market. Although desktop and wearable force-reflecting devices have been built and implemented in research laboratories, the current capabilities of such devices are quite limited. to realize the full promise of virtual environments and teleoperation of remote systems, further developments of haptic interfaces are critical. In this paper, the status and research needs in human haptics, technology development and interactions between the two are described. In particular, the excellent performance characteristics of Phantom, a haptic interface recently developed at MIT, are highlighted. Realistic sensations of single point of contact interactions with objects of variable geometry (e.g., smooth, textured, polyhedral) and material properties (e.g., friction, impedance) in the context of a variety of tasks (e.g., needle biopsy, switch panels) achieved through this device are described and the associated issues in haptic rendering are discussed.
Author
*Human-Computer Interface; Human Performance; Virtual Reality; Teleoperators; Sensorimotor Performance; Sensory Stimulation; Human Factors Engineering*

**19960026487**; 96N28132 Orr Associates International, Inc., Chesapeake, VA USA
**The power of pezonomics**
Orr, Joel N., Orr Associates International, Inc., USA; Nov. 1995, pp. 296-303; In English; Also announced as 19960026474; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This reflection of human-computer interface and its requirements as virtual technology is advanced, proposes a new term: 'Pezonomics'. The term replaces the term ergonomics ('the law of work') with a definition pointing to 'the law of play.' The necessity of this term, the author reasons, comes from the need to 'capture the essence of play and calibrate our computer systems to its cadences.' Pezonomics will ensure that artificial environments, in particular virtual reality, are user friendly.
CASI
*Human Factors Engineering; Human-Computer Interface; Computer Systems Design; User Requirements; Terminology*

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